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Miel, Mieris.

MIEL (Jan), called *Giovanni della Vite*, a moſt eminent painter, was born in Flanders in 1599. He was at firſt a diſciple of Gerard Seghers, in whoſe ſchool he made a diſtinguiſhed figure; but he quitted that artiſt, and went to Italy, to improve himſelf in deſign, and to obtain a more extenſive knowledge of the ſeveral branches of his art. At Rome he particularly ſtudied and copied the works of the Caracci and Corregio; and was admitted into the academy of Andrea Sacchi, where he gave ſuch evident proofs of extraordinary merit and genius, that he was invited by Andrea to aſſiſt him in a grand deſign which he had already begun. But Miel, through ſome diſguſt, rejected thoſe elevated ſubjects which at firſt had engaged his attention, refuſed the friendly propoſal of Sacchi, and choſe to imitate the ſtyle of Bamboccio, as having more of that nature which pleaſed his own imagination. His general ſubjects were huntings, carnivals, gypſies, beggars, paſtoral ſcenes, and converſations; of thoſe he compoſed his eaſel-pictures, which are the fineſt of his performances. But he alſo painted hiſtory in a large ſize in freſco, and in oil; which, though they ſeem to want elevation of deſign, and a greater degree of grace in the heads, yet appear ſuperior to what might be expected from a painter of ſuch low ſubjects as he generally was fond of repreſenting. His pictures of huntings are particularly admired: the figures and animals of every ſpecies being deſigned with uncommon ſpirit, nature, and truth. The tranſparence of his colouring, and the clear tints of his ſkies, enliven his compoſitions; nor are his paintings in any degree inferior to thoſe of Bamboccio either in their force or luſtre. His large works are not ſo much to be commended for the goodneſs of the deſign as for the expreſſion and colouring; but it is in his ſmall pieces that the pencil of Miel appears in its greateſt delicacy and beauty. The ſingular merit of this maſter recommended him to the favour of Charles Emanuel duke of Savoy, who invited him to his court, where he appointed Miel his principal painter, and afterwards honoured him with the order of St Mauritius, and made him a preſent of a croſs ſet with diamonds of a great value, as a particular mark of his eſteem. He died in 1664.

MIERIS (Francis), the *Old*, a juſtly celebrated painter, was born at Leyden in 1635; and was at firſt placed under the direction of Abraham Toorne Vliet, one of the beſt deſigners of the Low Countries, and afterwards entered himſelf as a diſciple with Gerard Douw. In a ſhort time he far ſurpaſſed all his companions, and was by his maſter called the prince of his diſciples. His manner of painting ſilks, velvets, ſtuffs, or carpets, was ſo ſingular, that the different kinds and fabric of any of them might eaſily be diſtinguiſhed. His pictures are rarely to be ſeen, and as rarely to be ſold; and when they are, the purchaſe is extremely high, their intrinſic value being ſo inconteſtably great. Beſide portraits, his general ſubjects were converſations, perſons performing on muſical inſtruments, patients attended by the apothecary or doctor, chymiſts at work, mercers ſhops, and ſuch like; and the uſual valuation he ſet on his pictures was eſtimated at the rate of a ducat an hour. The fineſt portrait of this maſter's hand is that which he painted for the wife of Cornelius Plaats, which is ſaid to be ſtill preſerved in the family, although very great ſums have been offered for it. In the poſſeſſion of the ſame gentleman was another picture of Mieris, repreſenting a lady fainting, and a phyſician applying the remedies to relieve her. For that performance he was paid (at his uſual rate of a ducat an hour) ſo much money as amounted to fifteen hundred florins when the picture was finiſhed. The grand duke of Tuſcany wiſhed to purchaſe it, and offered three thouſand florins for it, but the offer was not accepted. However, that prince procured ſeveral of his pictures, and they are at this day an ornament to the Florentine collection. One of the moſt curious of them is a girl holding a candle in her hand, and it is accounted ineſtimable. This painter died in 1681.

Mieris.

MIERIS (John), ſon of the former, was born at Leyden in 1660, and learned the art of painting from his father. The young artiſt unhappily was ſeverely afflicted with the gravel and ſtone; and by thoſe complaints was much hindered in the progreſs of his ſtudies. But, after the death of his father, he travelled to Germany, and from thence to Florence, where the fame of his father's merit procured him a moſt honourable reception from the grand duke, who, when he ſaw ſome of his paintings, endeavoured to retain him in his ſervice. But Mieris politely declined it, and proceeded to Rome, where his great abilities were well known before his arrival, and his works were exceedingly coveted. In that city his malady increaſed; yet at the intervals of eaſe he continued to work with his uſual application, till the violence of his diſtemper ended his days in 1690, when he was only thirty years old. He was allowed to have been as eminent for painting in a large ſize as his father had been for his works in ſmall.

MIERIS (William), called the *Young Mieris*, was brother to the former, and born at Leyden in 1662. During the life of his father, he made a remarkable progreſs: but, by being deprived of his director when he was only arrived at the age of nineteen, he had recourſe to nature, as the moſt inſtructive guide; and by ſtudying with diligence and judgment to imitate her, he approached near to the merit of his father. At firſt

firſt he took his ſubjects from private life, in the manner of Francis; ſuch as tradeſmen in their ſhops, or a peaſant ſelling vegetables and fruit, and ſometimes a woman looking out at a window; all which he copied minutely after nature, nor did he paint a ſingle object without his model. As Mieris had obſerved the compoſitions of Gerard Laireſſe, and other great hiſtorical painters, with ſingular delight, he attempted to deſign ſubjects in that ſtyle; and began with the ſtory of Rinaldo ſleeping on the lap of Armida, ſurrounded with the loves and graces, the fore-ground being enriched with plants and flowers; a work which added greatly to his fame, and was ſold for a very high price. This maſter alſo painted landſcapes and animals with equal truth and neatneſs; and modelled in clay and wax, in ſo ſharp and accurate a manner, that he might juſtly be ranked among the moſt eminent ſculptors. In the delicate finiſhing of his works, he imitated his father; as he likewiſe did in the luſtre, harmony, and truth, of his paintings, which makes them to be almoſt as highly prized; but they are not equal in reſpect of deſign, or of the ſtriking effect, nor is his touch ſo very exquiſite as that of the father. The works of the old Mieris are better compoſed, the figures are better grouped, and they have leſs confuſion; yet the younger Mieris is acknowledged to be an artiſt of extraordinary merit, although inferior to him, who had ſcarcely his equal. He died in 1747.

Mieris (Francis), called the *Young Francis*, was the ſon of William, and the grandſon of the celebrated Francis Mieris; and was born at Leyden in 1689. He learned the art of painting from his father, whoſe manner and ſtyle he always imitated; he choſe the ſame ſubjects, and endeavoured to reſemble him in his colouring and pencil. But with all his induſtry he proved far inferior to him: and moſt of thoſe pictures which at the public ſales are ſaid to be of the young Mieris, and many alſo in private collections aſcribed to the elder Francis, or William, are perhaps originally painted by this maſter, who was far inferior to both; or are only his copies after the works of thoſe excellent painters, as he ſpent abundance of his time in copying their performances.

MIEZA, (anc. geog.), a town of Macedonia, which was anciently called *Strymonium*, ſituated near Stagira. Here, Plutarch informs us, the ſtone ſeats and ſhady walks of Ariſtotle were ſhown. Of this place was Peuceſtas, one of Alexander's generals, and therefore ſurnamed *Miezæus*, (Arrian.)

MIGDOL, or Magdol, (anc. geog.), a place in the Lower Egypt, on this ſide Pihahiroth, or between it and the Red Sea, towards its extremity. The term denotes a tower or fortreſs. It is probably the *Magdolum* of Herodotus, ſeeing the Septuagint render it by the ſame name.

MIGNARD (Nicholas), a very ingenious French painter, born at Troyes in 1628; but, ſettling at Avignon, is generally diſtinguiſhed from his brother Peter by the appellation of *Mignard of Avignon*. He was afterwards employed at court and at Paris, where he became rector of the royal academy of painting. There are a great number of his hiſtorical pieces and portraits in the palace of the Thuilleries. He died in 1690.

Mignard (Peter), the brother of Nicholas, was born at Troyes in 1610; and acquired ſo much of the taſte of the Italian ſchool, as to be known by the name of the *Roman*. He was generally allowed to have a ſuperior genius to his brother Nicholas; and had the honour of painting the popes Alexander VII. and Urban VIII. beſides many of the nobility at Rome, and ſeveral of the Italian princes: his patron, Louis, ſat ten times to him for his portrait, and reſpected his talents ſo much as to ennoble him, make him his principal painter after the death of Le Brun, and appoint him director of the manufactories. He died in 1695, and many of his pieces are to be ſeen at St Cloud.

MIGNON, or Minjon, (Abraham), a celebrated painter of flowers and ſtill life, was born at Franckfort in 1639; and his father having been deprived of the greateſt part of his ſubſtance by a ſeries of loſſes in trade, left him in very neceſſitous circumſtances when he was only ſeven years of age. From that melancholy ſituation he was reſcued by the friendſhip of James Murel, a flower-painter in that city; who took Mignon into his own houſe, and inſtructed him in the art, till he was 17 years old. Murel had often obſerved an uncommon genius in Mignon: he therefore took him along with him to Holland, where he placed him as a diſciple with David de Heem; and while he was under the direction of that maſter he laboured with inceſſant application to imitate the manner of De Heem, and ever afterwards adhered to it; only adding daily to his improvement, by ſtudying nature with a moſt exact and curious obſervation.—"When we conſider the paintings of Mignon, one is at a loſs (Mr Pilkington obſerves) whether moſt to admire the freſhneſs and beauty of his colouring, the truth in every part, the bloom on his objects, or the perfect reſemblance of nature viſible in all his performances. He always ſhows a beautiful choice in thoſe flowers and fruits from which his ſubjects are compoſed: and he groups them with uncommon elegance. His touch is exquiſitely neat, though apparently eaſy and unlaboured; and he was fond of introducing inſects among the fruits and flowers, wonderfully finiſhed, ſo that even the drops of dew appear as round and as tranſlucent as nature itſelf." He had the good fortune to be highly paid for his works in his lifetime; and he certainly would have been accounted the beſt in his profeſſion even to this day, if John Van Huyſum had not appeared. Weyerman, who had ſeen many admired pictures of Mignon, mentions one of a moſt capital kind. The ſubject of it is a cat, which had thrown down a pot of flowers, and they lie ſcattered on a marble table. That picture is in every reſpect ſo wonderfully natural, that the ſpectator can ſcarce perſuade himſelf that the water which is ſpilled from the veſſel is not really running down from the marble. This picture is diſtinguiſhed by the title of *Mignon's Cat*. This painter died in 1679, aged only 40.

MIGRATION, the paſſage or removal of a thing out of one place into another.

Migration *of Birds*.—It has been generally believed, that many different kinds of birds annually paſs from one country to another, and ſpend the ſummer or the winter where it is moſt agreeable to them; and that even the birds of our own iſland will ſeek the moſt diſtant ſouthern regions of Africa, when directed by a peculiar inſtinct to leave their own country. It has

Migration. long been an opinion pretty generally received, that swallows reside during the winter-season in the warm southern regions; and Mr Adanson particularly relates his having seen them at Senegal when they were obliged to leave this country. But besides the swallow, Mr Pennant enumerates many other birds which migrate from Britain at different times of the year, and are then to be found in other countries; after which they again leave these countries, and return to Britain. The reason of these migrations he supposes to be a defect of food at certain seasons of the year, or the want of a secure asylum from the persecution of man during the time of courtship, incubation, and nutrition. The following is his list of the migrating species.

1. *Crows.* Of this genus, the hooded crow migrates regularly with the woodcock. It inhabits North Britain the whole year: a few are said annually to breed on Dartmoor, in Devonshire. It breeds also in Sweden and Austria: in some of the Swedish provinces it only shifts its quarters, in others it resides throughout the year. Our author is at a loss for the summer retreat of those which visit us in such numbers in winter, and quit our country in the spring; and for the reason why a bird, whose food is such that it may be found at all seasons in this country, should leave us.

2. *Cuckoo.* Disappears early in autumn; the retreat of this and the following bird is quite unknown to us.

3. *Wryneck.* Is a bird that leaves us in the winter. If its diet be ants alone, as several assert, the cause of its migration is very evident. This bird disappears before winter, and revisits us in the spring a little earlier than the cuckoo.

4. *Hoopoe.* Comes to England but by accident: Mr Pennant once indeed heard of a pair that attempted to make their nest in a meadow at Selborne, Hampshire, but were frighted away by the curiosity of people. It breeds in Germany.

5. *Grous.* The whole tribe, except the quail, lives here all the year round: that bird either leaves us, or else retires towards the sea-coasts.

6. *Pigeons.* Some few of the ring-doves breed here; but the multitude that appears in the winter is so disproportioned to what continue here the whole year, as to make it certain that the greatest part quit the country in the spring. It is most probable they go to Sweden to breed, and return from thence in autumn; as Mr Ekmark informs us they entirely quit that country before winter. Multitudes of the common wild pigeons also make the northern retreat, and visit us in winter; not but numbers breed in the high cliffs in all parts of this island. The turtle also probably leaves us in the winter, at least changes its place, removing to the southern counties.

7. *Stare.* Breeds here. Possibly several remove to other countries for that purpose, since the produce of those that continue here seems unequal to the clouds of them that appear in winter. It is not unlikely that many migrate into Sweden, where Mr Berger observes they return in spring.

8. *Thrushes.* The fieldfare and the redwing breed and pass their summers in Norway and other cold countries; their food is berries, which abounding in our kingdoms, tempts them here in the winter. These two and the Royston crow are the only land-birds that regularly and constantly migrate into England, and do not breed here. The hawfinch and crossbill come here at such uncertain times as not to deserve the name of birds of passage. Migration.

9. *Chatterer.* The chatterer appears annually about Edinburgh in flocks during winter; and feeds on the berries of the mountain-ash. In South Britain it is an accidental visitant.

10. *Grosbeaks.* The grosbeak and crossbill come here but seldom; they breed in Austria. The pine grosbeak probably breeds in the forests of the Highlands of Scotland.

11. *Buntings.* All the genus inhabits England throughout the year; except the greater brambling, which is forced here from the north in very severe seasons.

12. *Finches.* All continue in some parts of these kingdoms, except the siskin, which is an irregular visitant, said to come from Russia. The linnets shift their quarters, breeding in one part of this island, and remove with their young to others. All finches feed on the seeds of plants.

13. *Larks, fly-catchers, wagtails, and warblers.* All of these feed on insects and worms; yet only part of them quit these kingdoms; though the reason of migration is the same to all. The nightingale, black-cap, fly-catcher, willow-wren, wheat-ear, and white-throat, leave us before winter, while the small and delicate golden-crested wren braves our severest frosts. The migrants of this genus continue longest in Great Britain in the southern counties, the winter in those parts being later than in those of the north; Mr Stillingfleet having observed several wheat-ears in the isle of Purbeck on the 18th of November. As these birds are incapable of very distant flights, Spain, or the south of France, is probaby their winter-asylum.

14. *Swallows and goat-sucker.* Every species disappears at the approach of winter.

WATER-FOWL.

Of the vast variety of water-fowl that frequent Great Britain, it is amazing to reflect how few are known to breed here: the cause that principally urges them to leave this country, seems to be not merely the want of food, but the desire of a secure retreat. Our country is too populous for birds so shy and timid as the bulk of these are: when great part of our island was a mere waste, a tract of woods and fen, doubtless many species of birds (which at this time migrate) remained in security throughout the year.—Egrets, a species of heron now scarce known in this island, were in former times in prodigious plenty; and the crane, that has totally forsaken this country, bred familiarly in our marshes: their place of incubation, as well as of all other cloven-footed water-fowl (the heron excepted), being on the ground, and exposed to every one. As rural economy increased in this country, these animals were more and more disturbed; at length, by a series of alarms, they were necessitated to seek, during the summer, some lonely safe habitation.

On the contrary, those that build or lay in the almost inaccessible rocks that impend over the British seas, breed there still in vast numbers, having little to fear from the approach of mankind: the only disturb-

 ance

Migration. ance they meet with in general being from the deſperate attempts of ſome few to get their eggs.

CLOVEN-FOOTED WATER-FOWL.

15. *Herons.* The white heron is an uncommon bird, and viſits us at uncertain ſeaſons; the common kind and the bittern never leave us.

16. *Curlews.* The curlew breeds ſometimes on our mountains; but, conſidering the vaſt flights that appear in winter, it is probable that the greater part retire to other countries: the whimbrel breeds on the Grampian hills, in the neighbourhood of Invercauld.

17. *Snipes.* The woodcock breeds in the moiſt woods of Sweden, and other cold countries. Some ſnipes breed here, but the greateſt part retire elſewhere; as do every other ſpecies of this genus.

18. *Sandpipers.* The lapwing continues here the whole year; the ruff breeds here, but retires in winter; the redſhank and ſandpiper breed in this country, and reſide here. All the others abſent themſelves during ſummer.

19. *Plovers and oyſter-catcher.* The long-legged plover and ſanderling viſit us only in winter; the dottrel appears in ſpring and in autumn; yet, what is very ſingular, we do not find it breeds in ſouth Britain. The oyſter-catcher lives with us the whole year. The Norfolk plover and ſea-lark breed in England. The green plover breeds on the mountains of the north of England, and on the Grampian hills.

We muſt here remark, that every ſpecies of the genera of curlews, woodcocks, ſandpipers, and plovers, that forſake us in the ſpring, retire to Sweden, Poland, Pruſſia, Norway, and Lapland, to breed: as ſoon as the young can fly, they return to us again, becauſe the froſts which ſet in early in thoſe countries totally deprive them of the means of ſubſiſting; as the dryneſs and hardneſs of the ground, in general, during our ſummer, prevent them from penetrating the earth with their bills, in ſearch of worms, which are the natural food of theſe birds. Mr Ekmark ſpeaks thus of the retreat of the whole tribe of cloven-footed water fowl out of his country (Sweden) at the approach of winter; and Mr Klein gives much the ſame account of thoſe of Poland and Pruſſia.

20. *Rails and gallinules.* Every ſpecies of theſe two genera continue with us the whole year; the land-rail excepted, which is not ſeen here in winter. It likewiſe continues in Ireland only during the ſummer-months, when they are very numerous, as Mr Smith tells us in the *Hiſtory of Waterford*, p. 336. Great numbers appear in Angleſea the latter end of May; it is ſuppoſed that they paſs over from Ireland, the paſſage between the two iſlands being but ſmall. As we have inſtances of theſe birds lighting on ſhips in the channel and the Bay of Biſcay, we may conjecture their winter-quarters to be in Spain.

FINNED-FOOTED WATER-BIRDS.

21. *Phalaropes.* Viſit us but ſeldom; their breeding place is Lapland, and other arctic regions.

22. *Grebes.* The great-creſted grebe, the black and white grebe, and little grebe, breed with us, and never migrate; the others viſit us accidentally, and breed in Lapland.

WEB-FOOTED BIRDS.

23. *Avoſet.* Breed near Foſsdike in Lincolnſhire; but quit their quarters in winter. They are then ſhot in different parts of the kingdom, which they viſit, not regularly, but accidentally.

24. *Auks and guillemots.* The great auk or pinguin ſometimes breeds in St Kilda. The auk, the guillemot, and puffin, inhabit moſt of the maritime cliffs of Great Britain, in amazing numbers, during ſummer. The black guillemot breeds in the Baſs Iſle, and in St Kilda, and ſometimes in Llandidno rocks. We are at a loſs for the breeding place of the other ſpecies; neither can we be very certain of the winter reſidence of any of them, excepting of the leſſer guillemot and black-billed auk, which, during winter, viſit in vaſt flocks the Frith of Forth.

25. *Divers.* Theſe chiefly breed in the lakes of Sweden and Lapland, and in ſome countries near the pole; but ſome of the red-throated divers, the northern and the imber, may breed in the north of Scotland and its iſles.

26. *Terns.* Every ſpecies breeds here; but leaves us in the winter.

27. *Petrels.* The fulmar breeds in the Iſle of St Kilda, and continues there the whole year except September and part of October: the ſhearwater viſits the Iſle of Man in April; breeds there; and, leaving it in Auguſt or the beginning of September, diſperſes over all parts of the Atlantic ocean. The ſtormfinch is ſeen at all diſtances from land on the ſame vaſt watery tract; nor is ever found near the ſhore except by ſome very rare accident, unleſs in the breeding ſeaſon. Mr Pennant found it on ſome little rocky iſles, off the north of Skie. It alſo breeds in St Kilda. He alſo ſuſpects that it neſtles on the Blaſquet Iſles off Kerry, and that it is the gourder of Mr Smith.

28. *Merganſers.* This whole genus is mentioned among the birds that fill the Lapland lakes during ſummer. Mr Pennant has ſeen the young of the red-breaſted in the north of Scotland: a few of theſe, and perhaps of the gooſanders, may breed there.

29. *Ducks.* Of the numerous ſpecies that form this genus, we know of few that breed here: The ſwan and gooſe, the ſhield-duck, the eider-duck, a few ſhovelers, garganies, and teals, and a very ſmall portion of the wild ducks.

The reſt contribute to form that amazing multitude of water-fowl that annually repair from moſt parts of Europe to the woods and lakes of Lapland and other arctic regions, there to perform the functions of incubation and nutrition in full ſecurity. They and their young quit their retreat in September, and diſperſe themſelves over Europe. With us they make their appearance the beginning of October; circulate firſt round our ſhores; and, when compelled by ſevere froſt, betake themſelves to our lakes and rivers. Of the web-footed fowl there are ſome of hardier conſtitutions than others: theſe endure the ordinary winters of the more northern countries; but when the cold reigns there with more than common rigour, they repair for ſhelter to theſe kingdoms: this regulates the appearance of ſome of the diver kind, as alſo of the wild ſwans, the ſwallow-tailed ſhield-duck, and the different ſorts of gooſanders which then viſit our coaſts. Barentz found the barnacles with their neſts in great numbers in Nova Zembla. (*Collect. Voy. Dutch Eaſt-India Company*, 8vo. 1703, p. 19.) Cluſius, in his *Exot.* 368. alſo

Migration. also obferves, that the Dutch difcovered them on the rocks of that country and in Waygate Straits. They, as well as the other fpecies of wild-geefe, go very far north to breed, as appears from the hiftories of Greenland and Spitzbergen, by Egede and Crantz. Thefe birds feem to make Iceland a refting place, as Horrebow obferves: few continue there to breed, but only vifit that ifland in the fpring, and after a fhort ftay retire ftill further north.

30. *Corvorants.* The corvorant and fhag breed on moft of our high rocks: the gannet in fome of the Scotch ifles, and on the coaft of Kerry: the two firft continue on our fhores the whole year. The gannet difperfes itfelf all round the feas of Great Britain, in purfuit of the herring and pilchard, and even as far as the Tagus to prey on the fardina.

But of the numerous fpecies of fowl here enumerated, it may be obferved how very few intruft themfelves to us in the breeding feafon, and what a diftant flight they make to perform the firft great dictate of nature.

There feems to be fcarcely any but what we have traced to Lapland, a country of lakes, rivers, fwamps, and alps, covered with thick and gloomy forefts, that afford fhelter during fummer to thefe fowls, which in winter difperfe over the greateft part of Europe. In thofe arctic regions, by reafon of the thicknefs of the woods, the ground remains moift and penetrable to the woodcocks, and other flender-billed fowl: and for the web-footed birds, the waters afford larvæ innumerable of the tormenting knat. The days there are long; and the beautiful meteorous nights indulge them with every opportunity of collecting fo minute a food: whilft mankind is very fparingly fcattered over that vaft northern wafte.

Why then fhould Linnæus, the great explorer of thefe rude defarts, be amazed at the myriads of waterfowl that migrated with him out of Lapland? which exceeded in multitude the army of Xerxes; covering, for eight whole days and nights, the furface of the river Calix! His partial obfervation as a botanift, would confine their food to the vegetable kingdom, almoft denied to the Lapland waters; inattentive to a more plenteous table of infect food, which the all-bountiful Creator had fpread for them in the wildernefs. It may be remarked, that the lakes of mountainous rocky countries in general are deftitute of plants: few or none are feen on thofe of Switzerland; and Linnæus makes the fame obfervation in refpect to thofe of Lapland; having, during his whole tour, difcovered only a fingle fpecimen of a *lemma trifulca*, or "ivy-leaved duck's meat," *Flora Lap.* n° 470.; a few of the *fcirpus lacuftris*, or "bullrufh," n° 18.; the *alopecurus geniculatus*, or "flote foxtail grafs," n° 38.; and the *ranunculus aquatilis*, n° 234.; which are all he enumerates in his *Prolegomena* to that excellent performance.

Under the article Swallow will be found the principal arguments for and againft the migration of fwallows. Here we fhall give a fhort abftract of the arguments ufed by the Hon. Daines Barrington againft the migration of birds in general, from a paper publifhed by him in the 62d volume of the Philofophical Tranfactions. This gentleman denies that any wellattefted inftances can be produced of this fuppofed migration; which, he thinks, if there were any fuch periodical flight, could not poffibly have efcaped the frequent obfervation of feamen. It has indeed been afferted that birds of paffage become invifible in their flight, becaufe they rife too high in the air to be perceived, and becaufe they choofe the night for their paffage. The author, however, expreffes his doubts "whether any bird was ever feen to rife to a greater height than perhaps twice that of St Paul's crofs;" and he further endeavours to fhow, that the extent of fome of thefe fuppofed migrations (from the northern parts of Europe, for inftance, to the line) is too great to be accounted for, by having recourfe to the argument founded on a nocturnal paffage.

The author next recites, in a chronological order, all the inftances that he has been able to collect, of birds having been actually feen by mariners when they were croffing a large extent of fea; and he endeavours to fhow that no ftrefs can be laid on the few cafual obfervations of this kind that have been produced in fupport of the doctrine of a regular and periodical migration.

Mr Barrington afterwards proceeds to invalidate M. Adanfon's celebrated obfervation with refpect to the migration of the fwallow in particular, and which has been confidered by many as perfectly decifive of the prefent queftion. He endeavours to fhow that the four fwallows which that naturalift caught, on their fettling upon his fhip, on the 6th of October at about the diftance of 50 leagues from the coaft of Senegal, and which he fuppofes to have been then proceeding from Europe to pafs the winter in Africa, could not be true European fwallows; or, if they were, could not have been on their return from Europe to Africa. His objections are founded principally on fome proofs which he produces of M. Adanfon's want of accuracy on this fubject, which has led him, in the prefent inftance, to miftake two African fpecies of the fwallowtribe, defcribed and engraved by Briffon, for European fwallows, to which they bear a general refemblance; or granting even that they were European fwallows, he contends, that they were flitting from the Cape de Verd Iflands to the coaft of Africa; "to which fhort flight, however, they were unequal, and accordingly fell into the failor's hands." See the article Swallow.—We fhall here only add, in oppofition to the remarks of Mr Barrington, the following obfervations of the Rev. Mr White* in a letter to Mr Pennant on this fubject.

"We muft not (fays he) deny migration in general; becaufe migration certainly does fubfift in fome places, as my brother in Andalufia has fully informed me. Of the motions of thefe birds he has ocular demonftration, for many weeks together, both fpring and fall: during which periods myriads of the fwallow kind traverfe the Straits from north to fouth, and from fouth to north, according to the feafon. And thefe vaft migrations confift not only of hirundines, but of bee-birds, hoopoes, oro pendolos, or golden thrufhes, &c. &c. and alfo of many of our foft-billed fummer birds of paffage; and moreover of birds which never leave us, fuch as all the various forts of hawks and kites. Old Belon, 200 years ago, gives a curious account of the incredible armies of hawks and kites which he faw in the fpring-time traverfing the Thracian

* *Natural Hiftory of Selborne*, Letter ix. p. 139.

cian Bofphorus from Afia to Europe. Befides the above mentioned, he remarks, that the proceffion is fwelled by whole troops of eagles and vultures.

"Now it is no wonder that birds refiding in Africa fhould retreat before the fun as it advances, and retire to milder regions, and efpecially birds of prey, whofe blood being heated with hot animal food, are more impatient of a fultry climate: but then I cannot help wondering why kites and hawks, and fuch hardy birds as are known to defy all the feverity of England, and even of Sweden and all north Europe, fhould want to migrate from the fouth of Europe, and be diffatisfied with the winters of Andalufia.

"It does not appear to me that much ftrefs may be laid on the difficulty and hazard that birds muft run in their migrations, by reafon of vaft oceans, crofs winds, &c.; becaufe, if we reflect, a bird may travel from England to the equator without launching out and expofing itfelf to boundlefs feas, and that by croffing the water at Dover and again at Gibraltar. And I with the more confidence advance this obvious remark, becaufe my brother has always found that fome of his birds, and particularly the fwallow kind, are very fparing of their pains in croffing the Mediterranean: for when arrived at Gibraltar, they do not,

——"rang'd in figure, wedge their way,
——"and fet forth
"Their airy caravan high over feas
"Flying, and over lands with mutual wing
"Eafing their flight." MILTON.

but fcout and hurry along in little detached parties of fix or feven in a company; and fweeping low, juft over the furface of the land and water, direct their courfe to the oppofite continent at the narroweft paffage they can find. They ufually flope acrofs the bay to the fouth-weft, and fo pafs over oppofite to Tangier, which it feems is the narroweft fpace.

"In former letters we have confidered whether it was probable that woodcocks in moon-fhiny nights crofs the German ocean from Scandinavia. As a proof that birds of lefs fpeed may pafs that fea, confiderable as it is, I fhall relate the following incident, which, though mentioned to have happened fo many years ago, was ftrictly matter of fact:—As fome people were fhooting in the parifh of Trotton, in the county of Suffex, they killed a duck in that dreadful winter 1708-9, with a filver collar about its neck (I have read a like anecdote of a fwan), on which were engraven the arms of the king of Denmark. This anecdote the rector of Trotton at that time has often told to a near relation of mine; and, to the beft of my remembrance, the collar was in the poffeffion of the rector.

"At prefent I do not know any body near the feafide that will take the trouble to remark at what time of the moon woodcokes firft come. One thing I ufed to obferve when I was a fportfman, that there were times in which woodcocks were fo fluggifh and fleepy that they would drop again when flufhed juft before the fpaniels, nay juft at the muzzle of a gun that had been fired at them: whether this ftrange lazinefs was the effect of a recent fatiguing journey, I fhall not prefume to fay.

"Nightingales not only never reach Northumberland and Scotland, but alfo, as I have been always told, Devonfhire and Cornwall. In thofe two laft counties we cannot attribute the failure of them to the want of warmth: the defect in the weft is rather a prefumptive argument that thefe birds come over to us from the continent at the narroweft paffage, and do not ftroll fo far weftward."

Migration of Fifhes. See Clupea.

St MIGUEL, one of the Azore iflands, fituated in W. Long. 22. 45. N. Lat. 38. 10. This ifland appears to be entirely volcanic. The beft account we have of it hath been publifhed in the 68th volume of the Philofophical Tranfactions by Mr Francis Maffon. According to him, the productions differ greatly from thofe of Madeira, infomuch that none of the trees of the latter are found here, except the faya: it has a nearer affinity to Europe than Africa. The mountains are covered with the erica vulgaris, and an elegant ever-green fhrub very like a phillyrea, which gives them a moft beautiful appearance.

It is one of the principal and moft fertile of the Azorian iflands, lying nearly eaft and weft. Its length is about 18 or 20 leagues; its breadth unequal, not exceeding five leagues, and in fome places not more than two. It contains about 80,000 inhabitants.

Its capital, the city of Ponta del Guda, which contains about 12,000 inhabitants, is fituated on the fouth fide of the ifland, on a fine fertile plain country, pretty regularly built; the ftreets ftraight, and of a good breadth. It is fupplied with good water, which is brought about the diftance of three leagues from the neighbouring mountains. The churches and other religious edifices are elegant and well built for fuch an ifland. There is a large convent of Fracifcan friars and one of the order of St Auguftin, four convents for profeffed nuns, and three Recolhimentos for young women and widows who are not profeffed. The veffels anchor in an open road; but it is not dangerous, as no wind can prevent their going to fea in cafe of ftormy weather.

The country round the city is plain for feveral miles, well cultivated, and laid out with good tafte into fpacious fields, which are fown with wheat, barley, Indian corn, pulfe, &c. and commonly produce annually two crops; for as foon as one is taken off, another is immediately fown in its place. The foil is remarkably gentle and eafy to work, being for the moft part compofed of pulverifed pumice-ftone. There are in the plains a number of pleafant country-feats, with orchards of orange-trees, which are efteemed the beft in Europe.

The fecond town is Ribeira Grande, fituated on the north fide of the ifland, containing about as many inhabitants as the city; a large convent of Francifcan friars, and one of nuns. It gives title to a count, called the *Conde Ribeira Grande*, who firft inftituted linen and woollen manufactories in the ifland.

The third town is Villa Franca, on the fouth fide of the ifland, about fix leagues eaft of Ponta del Guda. It has a convent of Francifcan friars, and one of nuns, which contains about 300. Here, about half a mile from the fhore, lies a fmall ifland (Ilhao), which is hollow in the middle, and contains a fine bafon with only one entrance into it, fit to hold 50 fail of veffels fecure from all weather; at prefent it wants cleaning out,

out, as the winter rain washes down great quantities of earth into it, which has greatly diminished its depth. But vessels frequently anchor between this island and the main.

Beside these towns are several smaller, *viz.* Alagoa, Agoa de Pao, Brelanha, Fanaes de Ajuda, and a number of hamlets, called *lugars* or *places*.

About four leagues north-east from Villa Franca, lies a place called the *Furnas*, being a round deep valley in the middle of the east part of the island, surrounded with high mountains, which, though steep, may be easily ascended on horseback by two roads. The valley is about five or six leagues in circuit. The face of the mountains, which are very steep, is entirely covered with beautiful ever-greens, *viz.* myrtles, laurels, a large species of bilberry called *uva de serra*, &c. and numberless rivulets of the purest water run down their sides. The valley below is well cultivated, producing wheat, Indian corn, flax, &c. The fields are planted round with a beautiful sort of poplars, which grow into pyramidal forms, and by their careless, irregular disposition, together with the multitude of rivulets, which run in all directions through the valley, a number of boiling fountains throwing up clouds of steam, a fine lake in the south-west part about two leagues round, compose a prospect the finest that can be imagined. In the bottom of the valley the roads are smooth and easy, there being no rocks but a fine pulverised pumice-stone that the earth is composed of.

There are a number of hot fountains in different parts of the valley, and also on the sides of the mountains: but the most remarkable is that called the *chaldeira*, situated on the eastern part of the valley, on a small eminence by the side of a river, on which is a bason about 30 feet diameter, where the water continually boils with prodigious fury. A few yards distant from it is a cavern in the side of the bank, in which the water boils in a dreadful manner, throwing out a thick, muddy, unctuous water several yards from its mouth with a hideous noise. In the middle of the river are several places where the water boils up so hot, that a person cannot dip his finger into it without being scalded; also along its banks are several apertures, out of which the steam rises to a considerable height, so hot that there is no approaching it with one's hand: in other places, a person would think that 100 smiths bellows were blowing altogether, and sulphureous steams issuing out in thousands of places; so that native sulphur is found in every chink, and the ground covered with it like hoar-frost; even the bushes that happen to lie near these places are covered with pure brimstone, condensing from the steam that issues out of the ground, which in many places is covered over with a substance like burnt alum. In these small caverns, where the steam issues out, the people often boil their yams.

Near these boiling fountains are several mineral springs; two in particular, whose waters have a very strong quality, of an acid taste, and bitter to the tongue.

About half a mile to the westward, and close by the river side, are several hot springs, which are used by sick people with great success. Also, on the side of a hill west of St Ann's church, are many others, with three bathing-houses, which are most commonly used. These waters are very warm, although not boiling hot; but at the same place issue several streams of cold mineral water, by which they are tempered, according to every one's liking.

About a mile south of this place, and over a low ridge of hills, lies a fine lake about two leagues in circumference, and very deep, the water thick, and of a greenish colour. At the north end is a plain piece of ground, where the sulphureous steams issue out in many places, attended with a surprising blowing noise. Our author could observe strong springs in the lake, but could not determine whether they were hot or cold: this lake seems to have no visible evacuation. The other springs immediately form a considerable river, called *Ribeira Quente*, which runs a course about two or three leagues, through a deep rent in the mountains, on each side of which are several places where the smoke issues out. It discharges itself into the sea on the south side, near which are some places where the water boils up at some distance in the sea.

This wonderful place had been taken little notice of until very lately: so little curiosity had the gentlemen of the island, that scarcely any of them had seen it, until of late some persons, afflicted with very virulent disorders, were persuaded to try its waters, and found immediate relief from them. Since that time it has become more and more frequented; several persons who had lost the use of their limbs by the dead palsy have been cured; and also others who were troubled with eruptions on their bodies.

A clergyman, who was greatly afflicted with the gout, tried the said waters, and was in a short time perfectly cured, and has had no return of it since. When Mr Masson was there, several old gentlemen, who were quite worn out with the said disorder, were using the waters, and had received incredible benefit from them; in particular, an old gentleman about 60 years of age, who had been tormented with that disorder more than 20 years, and often confined to his bed for six months together: he had used these waters about three weeks, had quite recovered the use of his limbs, and walked about in the greatest spirits imaginable. A friar also who had been troubled with the said disorder about 12 years, and reduced to a cripple, by using them a short time was quite well, and went a-hunting every day.

There are several other hot springs in the island, particularly at Ribeira Grande; but they do not possess the same virtues, at least not in so great a degree.

The east and west part of the island rises into high mountains; but the middle is low, interspersed with round conic hills, all of which have very recent marks of fire; all the parts below the surface consisting of melted lava lying very hollow.

Most of the mountains to the westward have their tops hollowed out like a punch-bowl, and contain water. Near the west end is an immense deep valley like the Furnas called the *Sete Cidades*. This valley is surrounded with very abrupt mountains, about seven or eight leagues round; in the bottom is a deep lake of water, about three leagues in circuit, furnished with great number of water-fowls. This water has no mineral quality; neither are there any hot springs in the valley. All these mountains are composed of a

white-

Milan. white crumbly pumice-ſtone, which is ſo looſe, that if a perſon thruſt a ſtick into the banks, whole waggon-loads of it will tumble down. The inhabitants of the iſland relate a ſtory, that he who firſt diſcovered it obſerved an extraordinary high peak near the weſt end; but the ſecond time he viſited it, no ſuch peak was to be ſeen, which he ſuppoſed muſt have certainly ſunk: but, however improbable this ſtory may be, at ſome period or another it muſt have certainly been the caſe.

MILAN, or the duchy of the Milaneſe, a country of Italy, bounded on the weſt by Savoy, Piedmont, and Montferrat; by Switzerland on the north; by the territories of Venice, the duchies of Mantua, Parma, and Placentia, on the eaſt; and by the territories of Genoa on the ſouth.

Anciently this duchy, containing the north part of the Old Liguria, was called *Inſubria*, from its inhabitants the *Inſubres*; who were conquered by the Romans, as theſe were by the Goths; who in their turn were ſubdued by the Lombards. Didier, the laſt king of the Lombards, was taken priſoner by Charlemagne, who put an end to the Longobardic empire, and appointed governors of Milan. Theſe governors, being at a diſtance from their maſters, ſoon began to aſſume an independency, which brought a dreadful calamity on the country; for, in 1152, the capital itſelf was levelled with the ground by the emperor Frederic Barbaroſſa, who committed great devaſtations otherwiſe throughout the duchy. Under this emperor lived one Galvian, a nobleman who was deſcended from Otho a Milaneſe. Galvian, along with William prince of Montferrat, ſerved in the cruſade, when Godfrey of Boulogne took Jeruſalem: he killed in ſingle combat the Saracen general, whom he ſtripped of his helmet, which was adorned with the image of a ſerpent ſwallowing a youth; and this ever afterwards was the badge of that family. His grandſon Galvian, having oppoſed the emperor, was taken priſoner, and carried in irons into Germany, from whence he made his eſcape, and returned to Milan, died in the ſervice of his country. From him deſcended another Otho, at the time that Otho IV. was emperor of Germany, and who ſoon diſtinguiſhed himſelf by the accompliſhments both of his mind and body. When he grew up, he was received into the family of cardinal Octavian Ubaldini at Rome. This prelate, who was himſelf aſpiring at the popedom, was in a ſhort time greatly taken with the addreſs and accompliſhments of young Otho, and predicted his future greatneſs. In the mean time, one Torreſs, or Torriano, a Milaneſe nobleman of unbounded ambition, was attempting to make himſelf maſter of Milan. The popular faction had ſome time before been caballing againſt the nobility; and at laſt, Torriano, putting himſelf at their head, expelled the biſhop, and put to death or baniſhed all the nobility: by which means the popular government was fully eſtabliſhed; and Torriano, under this pretence, ruled every thing as he pleaſed. He was, however, ſoon oppoſed by one Franciſco Sepri, who formed a great party, pretending to deliver the city from Torriano's haughtineſs and cruelty. But while the two parties were collecting their forces againſt each other, cardinal Ubaldini was projecting the deſtruction of both, by means of his favourite Otho. This prelate had for ſome time borne an implacable hatred to Torriano, becauſe he had been by him prevented from carrying out of the treaſury of St Ambroſe's church at Milan, a carbuncle or jewel of great value, which he pretended to reſerve for adorning the papal tiara; for which reaſon he now determined to oppoſe his ambition.

Ubaldini began with naming Otho archbiſhop of Milan; which, as the pope's legate, he had a right to do. This nomination was confirmed by Pope Urban IV.; and the party of the nobility, having now got a head from the pope himſelf, began to gather ſtrength. Otho in the mean time employed himſelf in collecting troops; and had no ſooner procured a ſhow of an army, than he advanced towards Lago Maggione, and took poſſeſſion of Arona, a ſtrong poſt near that lake: but Torriano, marching immediately againſt him with all his troops, obliged him to abandon the place, and leave his party to make the beſt terms they could with the conqueror. This was followed by the deſtruction of the caſtles of Arona, Anghiari, and Brebia: ſoon after which Torriano died, and was ſucceeded by his brother Philip, who had ſufficient intereſt to get himſelf elected podeſta, or prætor of Milan, for ten years. During his lifetime, however, the party of the nobility increaſed conſiderably under Otho, notwithſtanding the check they had received. Philip died in 1265, having loſt ground conſiderably in the affections of the people, though he obtained a great reputation for his courage and conduct. His ſucceſſor Napi rendered himſelf terrible to nobility, whom he proſcribed, and put to death as often as he could get them into his power. He proceeded ſuch lengths, and acted with ſuch fury againſt that unfortunate party, that pope Clement IV. who had ſucceeded Urban, at laſt interdicted Milan, and excommunicated Napi and all his party. By this Napi began to loſe his popularity, and the public diſaffection towards him was much heightened by the natural cruelty of his temper. But in the mean time, the party of the nobility was in the utmoſt diſtreſs. Otho himſelf and his friends, having ſpent all their ſubſtance, wandered about from place to place; the pope not being in a capacity of giving them any aſſiſtance. Otho, however, was not diſcouraged by his bad ſucceſs, but found means ſtill to keep up the ſpirits of his party, who now choſe for their general Squarcini Burri, a man of great eminence and courage, whoſe daughter was married to Matthew Viſconti, afterwards called *Matthew the Great*. At the ſame time they renewed their confederacy with the marquis of Montferrat, who was ſon-in-law to the king of Spain. The marquis agreed to this confederacy chiefly with a view to become maſter of the Milaneſe.

The nobility now again began to make head; and having collected an army, which was joined by 600 Spaniſh cavalry and a body of foot, gained ſome advantages. But in the mean time Napi, having gathered together a ſuperior army, ſuddenly attacked Otho and Burri, and defeated them. After this diſaſter Otho applied to the pope; from whom, however, he did not obtain the aſſiſtance he deſired; and in the mean time Napi invited the emperor Rodolph into Italy, with the promiſe of being crowned at Milan. This invitation was accepted of with great readineſs by

by Rodolph; who constituted Napi his governor and vicar-general in Lombardy, sending to him at the same time a fine body of German horse, the command of which was given to Cassoni, Napi's nephew. On this Otho again applied to the pope (Gregory X.); but he was so far from granting him any assistance, that he is said to have entered into a scheme of assassinating him privately; but Otho escaped the danger, and in 1276 began to recover his affairs. The reason of pope Gregory's enmity to him was, that he and his party were thought to be Gibelines, and were opposed by great numbers of the nobility themselves; but after that pope's death, the Milanese exiles being united under one head, soon became formidable. They now chose for their general Godfrey count of Langusio, a noble Pavian, and an inveterate enemy of the Torriano family. This nobleman being rich and powerful, enlisted many German and other mercenaries, at whose head he marched towards the Lago Maggiore. All the towns in that country opened their gates to him, through the interest of the Visconti family, who resided in these parts. But this success soon met with a severe check in an unfortunate engagement, wherein Godfrey was defeated and taken prisoner; after which he and 34 nobles had their heads struck off, and sent from the field of battle piled up in a common waggon.

This defeat greatly affected Otho; but having in a short time recovered himself, he again attacked his enemies, and defeated them; but, suffering his troops to grow remiss after their victory, the fugitives rallied, and entirely defeated him. The next year, however, Otho had better success, and totally defeated and took prisoner Napi himself. After this victory Cassoni was obliged to abandon Milan to his competitor, who kept possession of it till his death, which happened in 1295, in the 87th year of his age.

Otho was succeeded by Matthew Visconti abovementioned; and Milan continued in subjection to that family without any very memorable occurrence till the year 1378, when, by the death of Galeazzo II. his brother Barnabo became sovereign of Milan. He was of a brave and active disposition; but excessively profuse in his expences, as his brother Galeazzo had also been; and to procure money to supply his extravagancies, was obliged to oppress his subjects. Galeazzo had engaged in an enterprise against Bologna, and the siege of it was continued by Barnabo. It lasted for nine years; and during this time is said to have cost 300 millions of gold, a prodigious sum in those days, near 40 millions sterling; the lowest gold coin being in value somewhat more than half-a-crown English. Both the brothers were excessively fond of building. Barnabo erected a bridge over the Adda, consisting of three stories; the lowest for chariots and heavy carriages, the middle for horses, and the uppermost for foot-passengers. He built also another bridge which was carried over houses without touching them. To accomplish these, and many other expensive schemes, he became one of the greatest tyrants imaginable, and every day produced fresh instances of his rapacity and cruelty. He instituted a chamber of inquiry, for punishing all those who had for five years before been guilty of killing boars, or even of eating them at the table of another. They who could not redeem themselves by money were hanged, and above 100 wretches perished in that manner. Those who had any thing to lose were stripped of all their substance, and obliged to labour at the fortifications and other public works. He obliged his subjects to maintain a great many hunting-dogs, and each district was taxed a certain number. The overseers of his dogs were at the same time the instruments of his rapacity. When the dogs were poor and slender, the owners were always fined; but when the dogs were fat, the owners were also fined for suffering them to live without exercise.

The extravagant behaviour of Barnabo soon rendered public affairs ready for a revolution, which was at last accomplished by his nephew John Galeazzo. He affected a solitary life, void of ambition, and even inclining to devotion; but at the same time took care to have his uncle's court filled with spies, who gave him information of all that passed. He reduced his table and manner of living, pretending that he took these steps as preparatives to a retirement from the world, which was soon to take place, after he had paid a religious vow. In short, he acted his part so well, that even Barnabo, though abundantly cautious, had no suspicion of his having any designs against him; and so entirely did he conceal his ambition, that he several times made application to his uncle for his interest to procure him a quiet retreat as soon as his religious vows were performed. One of these was to pay a visit to the church of the blessed Virgin upon mount Varezzio. This was to be done with so much secrecy that all kinds of eye-witnesses were to be excluded; and it was with difficulty that Barnabo himself and two of his sons were allowed to accompany our devotee. But, in the mean time, the hypocritical Galeazzo had soldiers advancing from all quarters; so that Barnabo and his sons were immediately seized, and the houses of those who had sided with them given up to be plundered. The booty in plate, money, and all kinds of rich furniture, was immense. The ministers of the late government were dragged from their hiding-places, and put to death; and at last the citadel itself fell into the hands of Galeazzo, who found in it an immense sum of money. Barnabo was carried prisoner to Tritici, a castle of his own building, where he had the happiness to find one person still faithful to him. This was his mistress, named *Dominia Porra*; who, when he was abandoned by all the world, shut herself up a voluntary prisoner in his chamber, and remained with him as long as he lived, which was only seven months after his degradation.

John Galeazzo was the first who took upon him the title of the *duke of Milan*, and was a prince of great policy and no less ambition. He made war with the Florentines, became master of Pisa and Bologna, and entirely defeated the emperor in 1401, so that he entertained hopes of becoming master of all Lombardy, and cutting off all possibility of invading it either from France or Germany; but his designs were frustrated by death, which happened in 1402, in the 55th year of his age. After his decease the Milanese government fell into the most violent distractions, so that it could

Milan. could not be fupported, even in time of peace, without an army of 20,000 foot and as many horfe. In the year 1421, however, Philip duke of Milan became mafter of Genoa; but though he gained great advantages in all parts of Italy, the different ftates ftill found means to counterbalance his fucceffes, and prevent him from enflaving them: fo that Milan never became the capital of any extenfive empire; and in 1437 Genoa revolted, and was never afterwards reduced.

Philip died in 1448, and by his death the male line of the Vifconti family was at an end. The next lawful heir was Valentina his fifter, who had married the duke of Orleans fon to Charles V. of France. By the contract of that marriage, the lawful progeny of it was to fucceed to the duchy of Milan in failure of the heirs-male of the Vifconti family; but this fucceffion was difputed by Sforza, who had married Philip's natural daughter. It is certain, however, that the rightful fucceffion was vefted in the houfe of Orleans and the kings of France; and therefore though the Sforza family got poffeffion of the duchy for the prefent, Louis XII. afterwards put in his claim, as being grandfon to John Galeazzo. For fome time he was fuccefsful; but the French behaved in fuch an infolent manner, that they were driven out of the Milanefe by the Swifs and Maximilian Sforza. The Swifs and Milanefe were in their turn expelled by Francis I. who obliged the Sforza family to relinquifh the government for a penfion of 30,000 ducats a-year. Francis Sforza, the fon of Maximilian, however, being affifted by the emperor and the pope, regained the poffeffion of the Milanefe about the year 1521; and, eight years after, the French king, by the treaty of Cambray, gave up his claim on the duchy.

But, in fact, the emperors of Germany feem to have had the faireft title to the Milanefe in right of their being for a long time fovereigns of Italy. On the death of Francis Sforza, therefore, in the year 1536, the emperor Charles V. declared the Milanefe to be an imperial fief, and granted the inveftiture of it to his fon Philip II. king of Spain. In his family it continued till the year 1706, when the French and Spaniards were driven out by the Imperialifts, and the emperor again took poffeffion of it as a fief. It was confirmed to his houfe by the treaty of Baden in 1714, by the quadruple alliance in 1718, and by the treaty of Aix-la Chapelle in 1748.

The duchy of Milan is one of the fineft provinces in Italy. It is bounded on the fouth by the Appenine mountains, and the territory of Genoa; on the north by Switzerland; on the eaft by the Venetian territories, and the duchies of Mantua, Parma, and Placentia; and on the weft by Savoy, Piedmont, and Montferrat; extending from north to fouth about 100 miles, and from eaft to weft about 108. It is well watered by the Teffino, the Sefia, the Adda, the Po, the Oglio, the Lombro, Serio. &c. and alfo by feveral canals and lakes. Of the latter, the Lago Maggiore is between 30 and 40 miles in length, and in fome places fix or feven miles broad. In it lie the *Boromean Iflands*, as they are called, viz. Ifola Bella and Ifola Madre, the beauty of which almoft exceeds imagination: art and nature feem to have vied with one another in embellifhing them. In each of them is a palace with delicious gardens, belonging to the Boromean family. The water of the lake is clear and of a greenifh colour, and abounds with fifh. The hills with which it is furrounded prefent a moft charming landfcape, being planted with vines and chefnut-trees, interfperfed with fummer-houfes. There is a canal running from it towards Switzerland, with which the city of Milan has a communication. It was anciently called *Lacus Verbanus*. The Lago de Como, which was called by the Latin poets *Lacus Larius*, but had its modern name from the city, near which it lies, extends itfelf about 30 miles northward from Como, but its greateft breadth is not above five miles. From the Lago Maggiore iffues the Teffino; and from that of Como the Adda. Of the other lakes, that of Lugano and Guarda are the chief: that of Guarda was anciently called *Benacus*.

The trade and manufactures of this duchy confift principally in filks, ftuffs, ftockings, gloves, and handkerchiefs, linen and woollen cloth, hardware, curious works of cryftal, agate, hyacinths, and other gems; but their exports are ufually far fhort of their imports.

As to the revenue of the duchy, it muft without doubt be very confiderable. It is faid to have amounted to 2,000,000 of dollars while the duchy was in the hands of Spaniards.

In the year 1767, the Auftrian government of Milan publifhed a law, by which all the rights which the pope or the bifhops had till then exercifed over ecclefiaftics, either with regard to their effects or perfons, is transferred to a council eftablifhed for that purpofe at Milan. By the fame edict, all ecclefiaftics were obliged to fell the eftates which they had become poffeffed of fince the year 1722; and no fubject, whether ecclefiaftic or fecular, was to go to Rome to folicit any favour, except letters of indulgence, without the confent of the faid council.

Milan, the capital of the duchy of that name, in Latin *Mediolanum*, is a very large city, and has a wall and rampart round it, with a citadel; yet is thought to be incapable of making any great refiftance. The gardens within the city take up a great deal of ground. In the citadel is a foundery for cannon, and an arfenal furnifhed with arms for 12,000 men. The governor of it is quite independent of the governor-general of the Milanefe, who refides in the city, in a large but old and ill-contrived palace. The yearly income of the governor of Milan is faid to be 200,000 guilders. The council belonging to the city is compofed of a prefident and 60 doctors of law, who are all nobles, and independent of the governor-general. Milan hath experienced a great variety of fortune, having been fubject fometimes to the French, fometimes to the Spaniards, and fometimes to the Germans. A great number of perfons of rank and fortune live in it, efpecially during the winter. The ladies in France are not allowed more liberty than thofe of this city: even the aufterities of the monaftic life are fo far mitigated here, that gentlemen have not only the liberty of talking with the nuns, and of rallying and laughing at the grate, but alfo of joining with them in concerts of mufic, and of fpending whole afternoons in their company. The place where the *beau monde* take the air, either in their coaches or on foot, is the rampart betwixt the Porta Orientale and the Porta Tofa, where it is ftraight and broad, and extremely pleafant,

pleasant, being planted with white mulberry-trees, and commanding a prospect on one side of the open country, and on the other of the gardens and vineyards between the ramparts and the city. Milan, which is said to have been built by the Gauls about 200 years after the foundation of Rome, contains a great number of stately edifices, as churches, convents, palaces, and hospitals. The cathedral is a vast pile, all of marble; and though something has been doing for near 400 years towards the outward or inward ornament thereof, it is not yet finished. Of the great number of statues about it, that of St Bartholomew, just flead alive, with his skin hanging over his shoulders; and of Adam and Eve, over the main portal, are the finest. The pillars supporting the roof of the church are all of marble, and the windows finely painted. This church contains a treasure of great value, particularly a shrine of rock-crystal, in which the body of St Charles Boromæo is deposited. The other churches most worthy a stranger's notice are those of St Alexander, St Jerom, St Giovanni di Casarotti della Passione, that of the Jesuits, and of St Ambrose, in which lie the bodies of the saint and of the kings Pepin and Bernard. In the Ambrosian college, founded by Frederic Boromæo, 16 professors teach gratis. In the same college is also an academy of painting, with a museum, and a library containing a vast number of printed books and manuscripts; among the last of which is a translation of Josephus's History of the Jews, done by Rufinus about 1200 years ago, and written on the bark of a tree; St Ambrose's works on vellum, finely illuminated; the orations of Gregory Nazianzen, and the works of Virgil, in folio, with Petrarch's notes. In the museum are Leonardi da Vinci's mathematical and mechanical drawings, in 12 large volumes. The seminary for sciences, the college of the nobles, the Helvetian college, and the mathematical academy, are noble foundations, and stately buildings. Of the hospitals, the most remarkable are the Lazaretto, and that called the *great hospital;* the latter of which receives sick persons, foundlings, and lunatics, and has six smaller hospitals depending on it, with a revenue of 100,000 rixdollars.

The number of the inhabitants of this city is said to be about 200,000. It has been 40 times besieged, taken 20 times, and four times almost entirely demolished; yet it hath always recovered itself. It is said that gunpowder is sold here only by one person, and in one place. The court of inquisition is held in the Dominican convent, near the church of Madonna della Gratia. The houses of entertainment, and the ordinaries here, are represented as very indifferent. Mr Keysler says, it is not unusual for young travellers, when they go to any of the taverns in Milan, to be asked, " whether they choose a *letto fornito*, or female bed-fellow," who continues masked till she enters the bed-chamber. Milan is described as inferior to Turin both in beauty and conveniency; many of the streets bing crooked and narrow, and paper-windows much more frequent than in that city; even in grand palaces, the windows are often composed promiscuously of glass and paper. Two large canals extend from hence, the one to the Tessino, and the other to the Adda; the Tessino having a communication with the Lago Maggiore, and, by a canal, with the Sesia; and the Adda issuing from the Lago di Como, and having a communication by canals with the Lambro and Serio. In a void space in one of the streets of Milan, where stood the house of a barber who had conspired with the commissary of health to poison his fellow-citizens, is erected a pillar called *Colonna Infame*, with an inscription to perpetuate the memory of the execrable design. The environs of this city are very pleasant, being adorned with beautiful seats, gardens, orchards, &c. About two Italian miles from it, at the seat of the Simonetti family, is a building, that would have been a master-piece of its kind had the architect designed it for an artificial echo. It will return or repeat the report of a pistol above 60 times; and any single musical instrument, well touched, will have the same effect as a great number of instruments, and produce a most surprising and delightful concert.

According to Dr Moore, " there is no place in Italy, perhaps in Europe, where strangers are received in such an easy hospitable manner as at Milan. Formerly the Milanese nobility displayed a degree of splendor and magnificence, not only in their entertainments, but in their usual style of living, unknown in any other country in Europe. They are under a necessity at present of living at less expence, but they still show the same obliging and hospitable disposition. This country having, not very long since, been possessed by the French, from whom it devolved to the Spaniards, and from them to the Germans, the troops of those nations have, at different periods, had their residence here, and, in the course of these vicissitudes, produced a style of manners, and stamped a character on the inhabitants of this duchy, different from what prevails in any other part of Italy; and nice observers imagine they perceive in Milanese manners the politeness, formality, and honesty imputed to those three nations, blended with the ingenuity natural to Italians. The great theatre having been burnt to the ground last year, there are no dramatic entertainments, except at a small temporary play-house, which is little frequented; but the company assemble every evening in their carriages on the ramparts, and drive about, in the same manner as at Naples, till it is pretty late. In Italy, the ladies have no notion of quitting their carriages at the public walks, and using their own legs, as in England and France. On seeing the number of servants, and the splendor of the equipages which appear every evening at the Corso on the ramparts, one would not suspect that degree of depopulation, and diminution of wealth, which we are assured has taken place within these few years all over the Milanese; and which proceeds from the burdensome nature of some late taxes, and the insolent and oppressive manner in which they are gathered." E. Long. 15. 35. N. Lat. 38. 32.

MILBORN-PORT, a town of Somersetshire in England, seated on a branch of the river Parret, 115 miles from London. Though it is represented in parliament, is no market-town nor corporation; but it appears in Domesday-book to have had a market once, and 56 burgesses. It is in a manner surrounded by Dorsetshire. Here are nine capital burgesses, who

yearly choose two bailiffs, that have the government of the borough under them, and jointly return the members to parliament with the two ftewards, who are chofen yearly out of nine commonalty ftewards, and have the cuftody of the corporation-feal. Thefe two ftewards alfo diftribute the profits of the lands given to the poor here, of which the faid commonalty ftewards are truftees. The inhabitants are about 1100, the houfes not much above 200. There are two fairs, June 6th and October 28th.

MILBROOK, a town of Cornwall, on the weft fide of Plymouth-Haven. It has a good fifhing-trade, and has formerly furnifhed our fleet with many able hands.

MILDENHALL, a town of Suffolk, feven miles from Newmarket, 12 from Bury, and 70 from London. It is a large populous town on the river Lark, a branch of the Oufe, with a harbour for boats. It has a well-frequented market on Fridays, efpecially for fifh and wild-fowl. Its church has a tower or fteeple 120 feet high.

MILDEW, is faid to be a kind of thick, clammy, fweet juice, exhaled from, or falling down upon, the leaves and bloffoms of plants. By its thicknefs and clamminefs it prevents perfpiration, and hinders the growth of the plant. It fometimes refts on the leaves of trees in form of a fatty juice, and fometimes on the ears of corn. It is naturally very tough and vifcous, and becomes ftill more fo by the fun's heat exhaling its more fluid parts; by which means the young ears of corn are fo daubed over, that they can never arrive at their full growth. Bearded wheat is lefs fubject to the mildew than the common fort; and it is obferved that newly-dunged lands are more liable to mildew than others. The beft remedy is a fmart fhower of rain, and immediately afterwards a brifk wind. If the mildew is feen before the fun has much power, it has been recommended to fend two men into the field with a long cord, each holding one end; and drawing this along the field through the ears, the dew will be diflodged from them, before the heat of the fun is able to dry it to that vifcous ftate in which it does the mifchief. Some alfo fay, that lands which have for many years been fubject to mildews, have been cured of it by fowing foot along with the corn, or immediately after it.

Mr J. S. Segar, the author of a treatife upon this fubject, obferves, that the mildew is of fuch a fharp corrofive nature, that it raifes blifters on the feet of the fhepherds who go barefoot, and even confumes the hoofs of the cattle. He fufpects that it poffeffes fome arfenical qualities, though he does not pretend to affirm this pofitively. Its pernicious influence, according to him, is rendered ftill more powerful by a variety of circumftances; fuch as fending the cattle into the fields too early in the fpring; their drinking water mixed with ice, or but lately thawed; their being kept in ftables that are two clofe and filthy, and which are not fufficiently aired. The fame author confiders the mildew as a principal caufe of epidemical diftempers among the cattle. The mildew producing thefe difeafes, he fays, is that which dries and burns the grafs and leaves. It falls ufually in the morning, particularly after a thunder-ftorm. Its poifonous quality (which does not continue above 24 hours) never operates but when it has been fwallowed immediately after its falling. The diforder attacks the ftomach, is accompanied with pimples on the tongue, lofs of appetite, a deficcation of the aliments in the ftomach, a cough, and difficulty of refpiration. As a prefervative, the author prefcribes purging in fpring and in winter. The medicine he advifes is compofed of 30 grains of fulphur of antimony, and 60 grains of refin of jalap. He is againft vomiting, and every thing that is of a heating nature.

MILE, a meafure of length or diftance, containing eight furlongs. The Englifh ftatute-mile is 80 chains, or 1760 yards; that is, 5280 feet.

We fhall here give a table of the miles in ufe among the principal nations of Europe, in geometrical paces, 60,000 of which make a degree of the equator.

	Geometrical paces.
Mile of Ruffia	750
of Italy	1000
of England	1200
of Scotland and Ireland	1500
Old league of France	1500
The fmall league, *ibid.*	2000
The mean league, *ibid.*	2500
The great league, *ibid.*	3000
Mile of Poland	3000
of Spain	3428
of Germany	4000
of Sweden	5000
of Denmark	5000
of Hungary	6000

MILETUS (anc. geog.), a town of Crete mentioned by Homer; but where fituated does not appear. It is faid to be the mother-town of Miletus in Caria, whither a colony was led by Sarpedon, Minos's brother, (Ephorus, quoted by Strabo). *Milefii*, the people, (Ovid).

Miletus (anc. geog.), a celebrated town of Afia Minor, on the confines of Ionia and Caria. It was the capital city of all Ionia, and famous both for the arts of war and peace. It was fituated about 10 ftadia fouth of the mouth of the river Mæander, near the fea-coaft. It was founded by a Cretan colony under Miletus, the companion of Bacchus; or (according to others) by Neleus the fon of Codrus; or by Sarpedon a fon of Jupiter. It has fucceffively been called *Lelegeis*, *Pithyufa*, and *Anactoria*. The inhabitants, called *Milefii*, were very powerful, and long maintained an obftinate war againft the kings of Lydia. They early applied themfelves to navigation; and planted no lefs than 80 colonies, or (according to Seneca) 380, in different parts of the world. It was the only town that made head againft Alexander, and with much difficulty taken. It gave birth to Thales, one of the feven wife men, and the firft who applied himfelf to the ftudy of nature. It was alfo the country of Anaximander, the fcholar and fucceffor of Thales, the inventor of fun-dials and the gnomon, and the firft that publifhed a geographical map; of Anaximance, fcholar and fucceffor to the foregoing; and of other great men. It was noted for its excellent wool, according to Virgil; and was alfo celebrated for a temple and oracle of Apollo Didymæus. This famous people, from being powerful, becoming

becoming afterwards opulent and abandoned to pleafures, loft both their riches and their power.—At prefent it is called by the Turks *Melas*, and not far diftant from it runs the river Mæander. St Paul going from Corinth to Jerufalem paffed by Miletus, and as he went by fea, and could not take Ephefus in his way, he caufed the bifhops and priefts of the church of Ephefus to come to Miletus (Acts xx. 15. &c.), which was about 12 leagues from them.

MILFOIL, or Yarrow. See Achillea.

MILFORD, a town of Suffex-county in the Delaware ftate, is fituated at the fource of a fmall river, 15 miles from Delaware bay, and 150 fouthward of Philadelphia. This town, which contains about 80 houfes, has been built, except one houfe, fince the revolution. It is laid out with much tafte, and is by no means difagreeable. The inhabitants are Epifcopalians, Quakers, and Methodifts.

Milford-Haven, one of the fineft harbours in Europe, and indifputably the beft in Britain, is fituated in Pembrokefhire in South-Wales, and lies on the north fide of the Briftol Channel. It is very large, fafe, and deep; there is no danger of going in or out with the tide, or almoft with any wind. If a fhip comes in without a cable or anchor, fhe may run afhore on the ooze, and there lie fafe till fhe is refitted; and in an hour's time fhe may get out of the harbour into the open fea. It lies extremely convenient for fhips bound from the Englifh or Briftol Channels to Ireland, or farther weft, and from thence to the Channels. It is faid, that 1000 fail of any fize may ride fecure in this haven. It has 16 deep and fafe creeks, five bays, and 13 roads, all diftinguifhed by their feveral names. The fpring tide rifes 36 feet; fo that fhips may at any time be laid afhore. Dale harbour is a ready out-let for fmall veffels, where they may ride in two or three fathoms at low-water.—In the reign of Queen Elizabeth, before the Spanifh invafion, two forts were begun at the entrance of Milford-Haven, one on each fide, called *Nangle* and *Dale* blockhoufes; but they were not then finifhed.—The Stack-rock rifes here above water, lying near the middle of the entrance between Nangle and Dale. Penermouth is the opening of that branch of the haven on which the town of Pembroke is feated, and where the cuftom-houfe of Milford is kept. The breadth of the entrance between rock and rock is but 200 yards at high-water, and 112 at low-water. There is a ridge of rocky ground that has the name of *Carrs*, which runs almoft acrofs Milford-Haven, from Peter-church towards Llanftadwell, where it renders the landing-place difficult to ftrangers, from its not appearing at low-water. The great convenience of this harbour is, that in an hour's time a fhip may be in or out of it, and in the way between the Land's-End and Ireland. As it lies near the mouth of the Severn, a fhip in eight or ten hours may be over on the coaft of Ireland, or off the Land's-End in the Englifh Channel; and a veffel may get out hence to the weft much fooner than from either Plymouth or Falmouth. This harbour has been greatly improved by new works, at the expence of the government. The parliament, on April 14. 1759, granted 10,000l. for fortifying the harbour of Milford, all of which was expended on the fort at Neyland, which, however, ftill remains unfinifhed.

MILIARY, in general, fomething refembling millet-feed.

Miliary-Fever. See Medicine, n° 229.

MILITANT, or Church-militant, denotes the body of Chriftians while here on earth.

MILITARY, fomething belonging to the foldiery or militia.

Military-Difcipline, the training of foldiers, and the due enforcement of the laws and regulations inftituted by authority for their conduct.

Next to the forming of troops, military difcipline is the firft object that prefents itfelf to our notice: it is the foul of all armies; and unlefs it be eftablifhed amongft them with great prudence, and fupported with unfhaken refolution, they are no better than fo many contemptible heaps of rabble, which are more dangerous to the very ftate that maintains them than even its declared enemies.

Military-Execution, the ravaging or deftroying of a country or town that refufes to pay the contribution inflicted upon them.

Military-Exercife. See Exercise and Words *of Command.*

Military-State, in Britifh polity, one of the three divifions of the laity. See Laity.

This ftate includes the whole of the foldiery, or fuch perfons as are peculiarly appointed among the reft of the people for the fafeguard and defence of the realm.

In a land of liberty, it is extremely dangerous to make a diftinct order of the profeffion of arms. In abfolute monarchies, this is neceffary for the fafety of the prince; and arifes from the main principle of their conftitution, which is that of governing by fear: but, in free ftates, the profeffion of a foldier, taken fingly and merely as a profeffion, is juftly an object of jealoufy. In thefe no man fhould take up arms but with a view to defend his country and its laws: he puts not off the citizen when he enters the camp; but it is becaufe he is a citizen, and would wifh to continue fo, that he makes himfelf for a while a foldier. The laws, therefore, and conftitution of thefe kingdoms, know no fuch ftate as that of a perpetual ftanding foldier, bred up to no other profeffion than that of war; and it was not till the reign of Henry VII. that the kings of England had fo much as a guard about their perfons.

In the time of the Anglo-Saxons, as appears from Edward the Confeffor's laws, the military force of England was in the hands of the dukes or heretochs, who were conftituted through every province and county in the kingdom; being taken out of the principal nobility, and fuch as were moft remarkable for being *fapientes, fideles, et animofi.* Their duty was to lead and regulate the Englifh armies, with a very unlimited power; *prout eis vifum fuerit, ad honorem coronæ et utilitatem regni.* And becaufe of this great power they were elected by the people in their full affembly, or folkmote, in the fame manner as fheriffs were elected: following ftill that old fundamental maxim of the Saxon conftitution, that where any officer was entrufted with fuch power, as, if abufed, might

tend to the oppreffion of the people, that power was delegated to him by the vote of the people themfelves. So too, among the ancient Germans, the anceftors of our Saxon forefathers, they had their dukes, as well as kings, with an independent power over the military, as the kings had over the civil ftate. The dukes were elective, the kings hereditary: for fo only can be confiftently underftood that paffage of Tacitus, *Reges ex nobilitate, duces ex virtute fumunt.* In conftituting their kings, the family or blood-royal was regarded; in choofing their dukes or leaders, warlike merit: juft as Cefar relates of their anceftors in his time, that whenever they went to war, by way either of attack or defence, they elected leaders to command them. This large fhare of power, thus conferred by the people, though intended to preferve the liberty of the fubject, was perhaps unreafonably detrimental to the prerogative of the crown: and accordingly we find a very ill ufe made of it by Edric duke of Mercia, in the reign of king Edmond Ironfide; who, by his office of duke or heretoch, was intitled to a large command in the king's army, and by his repeated treacheries at laft transferred the crown to Canute the Dane.

It feems univerfally agreed by all hiftorians, that king Alfred firft fettled a national militia in this kingdom, and by his prudent difcipline made all the fubjects of his dominions foldiers: but we are unfortunately left in the dark as to the particulars of this his fo celebrated regulation; though, from what was laft obferved, the dukes feem to have been left in poffeffion of too large and independent a power: which enabled duke Harold, on the death of Edward the Confeffor, though a ftranger to the royal blood, to mount for a fhort fpace the throne of this kingdom, in prejudice of Edgar Etheling the rightful heir.

Upon the Norman conqueft, the feodal law was introduced here in all its rigour, the whole of which is built on a military plan. In confequence thereof, all the lands in the kingdom were divided into what were called *knight's fees*, in number above 60,000; and for every knight's fee a knight or foldier, *miles*, was bound to attend the king in his wars, for 40 days in a year; in which fpace of time, before war was reduced to a fcience, the campaign was generally finifhed, and a kingdom either conquered or victorious. By this means the king had, without any expence, an army of 60,000 men always ready at his command. And accordingly we find one, among the laws of William the conqueror, which in the king's name commands and firmly enjoins the perfonal attendance of all knights and others; *quod habeant et teneant fe femper in armis et equis, ut decet et oportet: et quod femper fint prompti et parati ad fervitium fuum integrum nobis explendum et peragendum, cum opus adfuerit, fecundum quod debent de feodis et tenementis fuis de jure nobis facere.* This perfonal fervice in procefs of time degenerated into pecuniary commutations or aids; and at laft the military part of the feodal fyftem was abolifhed at the Reftoration, by ftatute 12 Car. II. c. 24. See *Feodal-Syftem.*

In the meantime, we are not to imagine that the kingdom was left wholly without defence in cafe of domeftic infurrections, or the profpect of foreign invafions. Befides thofe who by their military tenures were bound to perform 40 days fervice in the field, firft the affize of arms, enacted 27 Hen. II. and afterwards the ftatute of Winchefter, under Edward I. obliged every man, according to his eftate and degree, to provide a determinate quantity of fuch arms as were then in ufe, in order to keep the peace; and conftables were appointed in all hundreds by the latter ftatute, to fee that fuch arms were provided. Thefe weapons were changed, by the ftatute 4 & 5 Ph. & M. c. 2. into others of more modern fervice; but both this and the former provifions were repealed in the reign of James I. While thefe continued in force, it was ufual from time to time for our princes to iffue commiffions of array, and fend into every county officers in whom they could confide, to mufter and array (or fet in military order) the inhabitants of every diftrict; and the form of the commiffion of array was fettled in parliament in the 5 Hen. IV. But at the fame time it was provided, that no man fhould be compelled to go out of the kingdom at any rate, nor out of his fhire, but in cafes of urgent neceffity; nor fhould provide foldiers unlefs by confent of parliament. About the reign of king Henry VIII. and his children, lord-lieutenants began to be introduced, as ftanding reprefentatives of the crown, to keep the counties in military order; for we find them mentioned as known officers in the ftatute 4 & 5 Ph. & M. c. 3. though they had not been then long in ufe; for Cambden fpeaks of them in the time of Queen Elizabeth as extraordinary magiftrates, conftituted only in times of difficulty and danger.

In this ftate things continued till the repeal of the ftatutes of armour in the reign of king James I.; after which, when king Charles I. had, during his northern expeditions, iffued commiffions of lieutenancy, and exerted fome military powers which, having been long exercifed, were thought to belong to the crown, it became a queftion in the long-parliament, how far the power of the militia did inherently refide in the king; being now unfupported by any ftatute, and founded only upon immemorial ufage. This queftion, long agitated with great heat and refentment on both fides, became at length the immediate caufe of the fatal rupture between the king and his parliament: the two houfes not only denying this prerogative of the crown, the legality of which claim perhaps might be fomewhat doubtful; but alfo feizing into their hands the entire power of the militia, the illegality of which ftep could never be any doubt at all.

Soon after the reftoration of king Char. II. when the military tenures were abolifhed, it was thought proper to afcertain the power of the militia, to recognife the fole right of the crown to govern and command them, and to put the whole into a more regular method of military fubordination: and the order in which the militia now ftands by law, is principally built upon the ftatutes which were then enacted. It is true, the two laft of them are apparently repealed; but many of their provifions are re-enacted, with the addition of fome new regulations, by the prefent militia-laws; the general fcheme of which is to difcipline a certain number of the inhabitants of every county, chofen by lot for three years, and officered by the lord-lieutenant, the deputy-lieutenants, and other principal landholders, under a commiffion from the crown. They are not compellable to march out of their counties, unlefs

Military. in caſe of invaſion or actual rebellion, nor in any caſe compellable to march out of the kingdom. They are to be exerciſed at ſtated times: and their diſcipline in general is liberal and eaſy; but, when drawn out into actual ſervice, they are ſubject to the rigours of martial law, as neceſſary to keep them in order. This is the conſtitutional ſecurity which our laws have provided for the public peace, and for protecting the realm againſt foreign or domeſtic violence; and which the ſtatutes declare is eſſentially neceſſary to the ſafety and proſperity of the kingdom.

When the nation was engaged in war, more veteran troops and more regular diſcipline were eſteemed to be neceſſary, than could be expected from a mere militia; and therefore at ſuch times more rigorous methods were put in uſe for the raiſing of armies and the due regulation and diſcipline of the ſoldiery: which are to be looked upon only as temporary excreſcences bred out of the diſtemper of the ſtate, and not as any part of the permanent and perpetual laws of the kingdom. For martial law, which is built upon no ſettled principles, but is entirely arbitrary in its deciſions, is, as Sir Matthew Hale obſerves, in truth and reality no law, but ſomething indulged rather than allowed as a law. The neceſſity of order and diſcipline in an army is the only thing which can give it countenance; and therefore it ought not to be permitted in time of peace, when the king's courts are open for all perſons to receive juſtice according to the laws of the land. Wherefore, Thomas earl of Lancaſter being convicted at Pontefract, 15 Edw. II. by martial law, his attainder was reverſed 1 Edw. III. becauſe it was done in time of peace. And it is laid down, that if a lieutenant, or other, that hath commiſſion of martial authority, doth in time of peace hang or otherwiſe execute any man by colour of martial law, this is murder; for it is againſt *magna carta*. And the petition of right enacts, that no ſoldier ſhall be quartered on the ſubject without his own conſent; and that no commiſſion ſhall iſſue to proceed within this land according to martial law. And whereas, after the Reſtoration, king Ch. II. kept up about 5000 regular troops, by his own authority, for guards and garriſons; which king James II. by degrees increaſed to no leſs than 30,000, all paid from his own civil liſt; it was made one of the articles of the bill of rights, that the raiſing or keeping a ſtanding army within the kingdom in time of peace, unleſs it be with conſent of parliament, is againſt law.

But as the faſhion of keeping ſtanding armies (which was firſt introduced by Charles VII. in France, 1445) has of late years univerſally prevailed over Europe (tho' ſome of its potentates, being unable themſelves to maintain them, are obliged to have recourſe to richer powers, and receive ſubſidiary penſions for that purpoſe), it has alſo for many years paſt been annually judged neceſſary by our legiſlature, for the ſafety of the kingdom, the defence of the poſſeſſions of the crown of Great Britain, and the preſervation of the balance of power in Europe, to maintain even in time of peace a ſtanding body of troops, under the command of the crown; who are however *ipſo facto* diſbanded at the expiration of every year, unleſs continued by parliament. And it was enacted by ſtatute 10 W. III. c. 1. that not more than 12,000 regular forces ſhould be kept on foot in Ireland, though paid at the charge of that kingdom: which permiſſion is extended by ſtat. 8. Geo. III. c. 13. to 16,235 men in time of peace. Military.

To prevent the executive power from being able to oppreſs, ſays baron Monteſquieu, it is requiſite that the armies with which it is entruſted ſhould conſiſt of the people, and have the ſame ſpirit with the people; as was the caſe at Rome, till Marius new-modelled the legions by enliſting the rabble of Italy, and laid the foundation of all the military tyranny that enſued. Nothing then, according to theſe principles, ought to be more guarded againſt in a free ſtate, than making the military power, when ſuch a one is neceſſary to be kept on foot, a body too diſtinct from the people. Like ours, therefore, it ſhould wholly be compoſed of natural ſubjects; it ought only to be enliſted for a ſhort and limited time; the ſoldiers alſo ſhould live intermixed with the people; no ſeparate camp, no barracks, no inland fortreſſes, ſhould be allowed. And perhaps it might be ſtill better, if, by diſmiſſing a ſtated number, and enliſting others at every renewal of their term, a circulation could be kept up between the army and the people, and the citizen and the ſoldier be more intimately connected together.

To keep this body of troops in order, an annual act of parliament likewiſe paſſes, "to puniſh mutiny and deſertion, and for the better payment of the army and their quarters." This regulates the manner in which they are to be diſperſed among the ſeveral inn-keepers and victuallers throughout the kingdom; and eſtabliſhes a law-martial for their government. By this, among other things, it is enacted, that if any officer or ſoldier ſhall excite, or join any mutiny, or, knowing of it, ſhall not give notice to the commanding officer, or ſhall deſert, or liſt in any other regiment, or ſleep upon his poſt, or leave it before he is relieved, or hold correſpondence with a rebel or enemy, or ſtrike or uſe violence to his ſuperior officer, or ſhall diſobey his lawful commands; ſuch offender ſhall ſuffer ſuch puniſhment as a court-martial ſhall inflict, though it extend to death itſelf.

However expedient the moſt ſtrict regulations may be in time of actual war, yet in times of profound peace, a little relaxation of military rigour would not, one ſhould hope, be productive of much inconvenience. And, upon this principle, though by our ſtanding laws (ſtill remaining in force, though not attended to) deſertion in time of war is made felony without benefit of clergy, and the offence is triable by a jury, and before the judges of the common law; yet, by our militia laws beforementioned, a much lighter puniſhment is inflicted for deſertion in time of peace. So, by the Roman law alſo, deſertion in time of war was puniſhed with death, but more mildly in time of tranquillity. But our mutiny-act makes no ſuch diſtinction: for any of the faults abovementioned are, equally at all times, puniſhable with death itſelf, if a court-martial ſhall think proper. This diſcretionary power of the court-martial is indeed to be guided by the directions of the crown; which, with regard to military offences, has almoſt an abſolute legiſlative power. "His Majeſty (ſays the act) may form articles of war, and conſtitute courts-martial with power to try any crime by ſuch articles, and inflict ſuch penalties as the articles direct."

4

Military. direct." A vaſt and moſt important truſt! an unlimited power to create crimes, and annex to them any puniſhments not extending to life or limb! Theſe are indeed forbidden to be inflicted, except for crimes declared to be ſo puniſhable by this act; which crimes we have juſt enumerated, and among which, we may obſerve, that any diſobedience to lawful commands is one. Perhaps in ſome future reviſion of this act, which is in many reſpects haſtily penned, it may be thought worthy the wiſdom of parliament to aſcertain the limits of military ſubjection, and to enact expreſs articles of war for the government of the army, as is done for the government of the navy; eſpecially as, by our preſent conſtitution, the nobility and gentry of the kingdom, who ſerve their country as militia officers, are annually ſubjected to the ſame arbitrary rule during their time of exerciſe.

One of the greateſt advantages of our law is, that not only the crimes themſelves which it puniſhes, but alſo the penalties which it inflicts, are aſcertained and notorious: nothing is left to arbitrary diſcretion; the king by his judges diſpenſes what the law has previouſly ordained, but is not himſelf the legiſlator. How much, therefore, is it to be regretted, that a ſet of men, whoſe bravery has ſo often preſerved the liberties of their country, ſhould be reduced to a ſtate of ſervitude in the midſt of a nation of freemen; for Sir Edward Coke will inform us, that it is one of the genuine marks of ſervitude, to have the law, which is our rule of action, either concealed or precarious; *Miſera eſt ſervitus, ubi jus eſt vagum aut incognitum.* Nor is this ſtate of ſervitude quite conſiſtent with the maxims of ſound policy obſerved by other free nations. For the greater the general liberty is which any ſtate enjoys, the more cautious has it uſually been in introducing ſlavery in any particular order or profeſſion. Theſe men, as baron Monteſquieu obſerves, ſeeing the liberty which others poſſeſs, and which they themſelves are excluded from, are apt (like eunuchs in the eaſtern ſeraglios) to live in a ſtate of perpetual envy and hatred towards the reſt of the community, and indulge a malignant pleaſure in contributing to deſtroy thoſe privileges to which they can never be admitted. Hence have many free ſtates, by departing from this rule, been endangered by the revolt of their ſlaves; while, in abſolute and deſpotic governments, where no real liberty exiſts, and conſequently no invidious compariſons can be formed, ſuch incidents are extremely rare. Two precautions are therefore adviſed to be obſerved in all prudent and free governments: 1. To prevent the introduction of ſlavery at all: or, 2. If it be already introduced, not to entruſt thoſe ſlaves with arms, who will then find themſelves an overmatch for the freemen. Much leſs ought the ſoldiery to be an exception to the people in general, and the only ſtate of ſervitude in the nation.

Blackſt. Comment.

But as ſoldiers, by this annual act, are thus put in a worſe condition than any other ſubjects; ſo, by the humanity of our ſtanding laws, they are in ſome caſes put in a much better. By ſtatute 43 Eliz. c. 3. a weekly allowance is to be raiſed in every county for the relief of ſoldiers that are ſick, hurt, and maimed: not forgetting the royal hoſpital at Chelſea for ſuch as are worn out in their duty. Officers and ſoldiers, that have been in the king's ſervice, are by ſeveral ſtatutes, enacted at the cloſe of ſeveral wars, at liberty to uſe any trade or occupation they are fit for, in any town in the kingdom (except the two univerſities), notwithſtanding any ſtatute, cuſtom, or charter to the contrary. And ſoldiers in actual military ſervice may make nuncupative wills, and diſpoſe of their goods, wages, and other perſonal chattels, without theſe forms, ſolemnities, and expences, which the law requires in other caſes. Our law does not indeed extend this privilege ſo far as the civil law, which carried it to an extreme that borders upon the ridiculous: for if a ſoldier, in the article of death, wrote any thing in bloody letters on his ſhield, or in the duſt of the field with his ſword, it was a very good military teſtament.

Military || Milium.

Military Court. See Chivalry (*Court of*),

Military Tenures. See Tenure, Feodal System, and Knight.

Military Ways (*viæ militares*), are the large Roman roads which Agrippa procured to be made through the empire, in the time of Auguſtus, for the more convenient marching of troops and conveyance of carriages. N. Bergier has written the hiſtory of the origin, progreſs, and amazing extent, of theſe military roads, which were paved from the gates of Rome to the extreme parts of the empire. See Way.

MILITIA, in general, denotes the body of ſoldiers, or thoſe who make profeſſion of arms.

In a more reſtrained ſenſe, militia denotes the trained bands of a town or country, who arm themſelves, upon a ſhort warning, for their own defence. So that, in this ſenſe, militia is oppoſed to regular or ſtated troops. See *Military State*, and *Feodal Syſtem.*

MILIUM, millet, in botany; A genus of the digynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 4th order, *Gramina.* The calyx is bivalved, and uniflorous; the corolla is very ſhort; the ſtigmata pencil like.—There are five ſpecies; of which the moſt remarkable is the panicum, or common millet. This is a native of India, but is now commonly cultivated in many parts of Europe as an eſculent grain. It riſes, with a reed-like ſtalk, three or four feet high, and channelled: at every joint there is one reed-like leaf, which is joined on the top of the ſheath, and embraces and covers that joint of the ſtalk below the leaf; this ſheath is cloſely covered with ſoft hairs, but the leaf which is expanded has none. The top of the ſtalk is terminated by a large looſe panicle, which hangs on one ſide, having a chaffy flower, which is ſucceeded by a ſmall round ſeed. There are two varieties; one with white, and the other with black ſeeds; but they do not differ in any other particular. This plant is greatly cultivated in the oriental countries, and from whence we are annually furniſhed with it. It is ſeldom cultivated in Britain but in ſmall gardens, for feeding of poultry, where the ſeeds generally ripen very well. It is uſed as an ingredient in puddings, and is by ſome people greatly eſteemed. The ſeeds muſt be ſown in the beginning of April, upon a warm dry ſoil, but not too thick, becauſe the plants divide into ſeveral branches, and ſhould have much room. When they come up they ſhould be cleaned from weeds; after which they will

will in a ſhort time get the better of them, and prevent the future growth. In Auguſt the ſeeds will ripen, when the plant muſt be cut down, and the ſeeds beaten out, as is practiſed for other grain; but if it is not protected from birds, they will devour it as ſoon as it begins to ripen.

MILK, a well-known fluid, prepared by nature in the breaſts of women, and the udders of other animals, for the nouriſhment of their young.—According to Dr Cullen *, milk is a connecting and intermediate ſubſtance between animals and vegetables. It ſeems immediately to be ſecreted from the chyle, both being a white liquor of the ſame conſiſtence: it is moſt copiouſly ſecreted after meals, and of an aceſcent nature. In moſt animals who lives on vegetables, the milk is aceſcent; and it is uncertain, though at the ſame time no obſervation proves the contrary, whether it is not ſo likewiſe in carnivorous animals. But, whatever be in this, it is certain, that the milk of all animals who live on vegetables is aceſcent. Milk being derived from the chyle, we thence conclude its vegetable nature; for in thoſe who live on both promiſcuouſly, more milk is got, and more quickly, from the vegetable than the animal food. Milk, however, is not purely vegetable; though we have a vegetable liquor that reſembles its taſte, conſiſtence, colour, aceſcency, and the ſeparability of the oily part, viz. an emulſion of the nuces oleoſæ and farinaceous ſubſtances. But theſe want the coagulable part of milk, which ſeems to be of animal-nature, approaching to that of the coagulable lymph of the blood. Milk, then, ſeems to be of an intermediate nature, between chyle taken up from the inteſtines and the fully elaborated animal-fluid.

* *Lect. on Mat. Med.*

Its contents are of three kinds: firſt, an oily part, which, whatever may be ſaid concerning the origin of other oils in the body, is certainly immediately derived from the oil of the vegetables taken in, as with theſe it agrees very exactly in its nature, and would entirely if we could ſeparate it fully from the coagulable part. Another mark of their agreement is the ſeparability, which proves that the mixture has been lately attempted, but not fully performed. 2dly, Beſides this oily, there is a proper coagulable part: And, 3dly, Much water accompanies both, in which there is diſſolved a ſaline ſaccharine ſubſtance. Theſe three can be got ſeparate in cheeſe, butter, and whey; but never perfectly ſo, a part of each being always blended with every other part.

Nothing is more common, from what has been ſaid of its immediate nature, than to ſuppoſe that it requires no aſſimilation; and hence has been deduced the reaſon of its exhibition in the moſt weakly ſtate of the human body. But wherever we can examine milk, we always find that it coagulates, ſuffers a decompoſition, and becomes aceſcent. Again, infants, who feed entirely on milk, are always troubled with eructations, which every body obſerves are not of the ſame quality with the food taken; and therefore it appears, that, like all other food, milk turns naturally aceſcent in the ſtomach, and only enters the chyle and blood in conſequence of a new recompoſition. It approaches then to the nature of vegetable aliment, but is not capable of its noxious vinous fermentation, and therefore has an advantage over it; neither from this quality, like animal-food, is it heating in the ſtomach, and productive of fever; though at the ſame time, from its quantity of coagulable matter, it is more flouriſhing than vegetables.

Milk is the food moſt univerſally ſuited to all ages and ſtates of the body; but it ſeems chiefly deſigned by nature as the food of infants. When animals are in the fœtus-ſtate, their ſolids are a perfect jelly, incapable of an aſſimilatory power. In ſuch ſtate nature has perfectly aſſimilated food, as the albumen ovi in the oviparous, and in the viviparous animals certainly ſomewhat of the ſame kind, as it was neceſſary the veſſels ſhould be filled with ſuch a fluid as would make way for an after-aſſimilation. When the infant has attained a conſiderable degree of firmneſs, as when it is ſeparated from the mother, yet ſuch a degree of weakneſs ſtill remains as makes ſomewhat of the ſame indication neceſſary, it behoves the infant to have an alkaleſcent food ready prepared, and at the ſame time its noxious tendency to be avoided. Milk then is given, which is alkaleſcent, and, at the ſame time, has a ſufficient quantity of acidity to correct that alkaleſcency. As the body advances in growth, and the alkaleſcent tendency is greater, the animal, to obviate that tendency, is led to take vegetable food, as more ſuited to its ſtrength of aſſimilation.

Dr Cullen obſerves, that milk is almoſt ſuited to all temperaments; and it is even ſo to ſtomachs diſpoſed to aceſcency, more than thoſe ſubſtances which have undergone the vinous fermentation; nay, it even cures the heart-burn, checks vinous fermentation, and precipitates the lees, when, by renewal of fermentation, the wine happens to be fouled. It therefore very properly accompanies a great deal of vegetable aliment; although ſometimes its aceſcency is troubleſome, either from a large proportion taken in, or from the degree of it; for, according to certain unaccountable circumſtances, different acids are formed in the ſtomach in different ſtates of the body; in a healthy body, *e. g.* a mild one; in the hypochondriac diſeaſe, one ſometimes as corroſive as the foſſil acid. When the acidity of milk is carried to a great degree, it may prove remarkably refrigerent, and occaſion cold crudities, and the recurrence of intermittent fevers. To take the common notion of its paſſing unchanged into the blood, it can ſuffer no ſolution. But if we admit its coagulum in the ſtomach, then it may be reckoned among ſoluble or inſoluble foods, according as that coagulum is more or leſs tenacious. Formerly rennet, which is employed to coagulate milk, was thought an acid; but, from late obſervations, it appears, that, if it be an acid, it is very different from other acids, and that its coagulum is ſtronger than that produced by acids. It has been imagined, that a rennet is to be found in the ſtomachs of all animals, which cauſes coagulation of milk; but to Dr Cullen the coagulation of milk ſeems to be owing to a weak acid in the ſtomach, the relicts of our vegetable food, inducing, in healthy perſons, a weak and ſoluble coagulum: but in different ſtomachs this may be very different, in theſe becoming heavy and leſs ſoluble food, and ſometimes even evacuated in a coagulated undiſſolved ſtate both by ſtomach and ſtool.

As milk is aceſcent, it may be rendered ſometimes purgative by mixing with the bile; and ſome examples of

of this have been remarked. More commonly, however, it is reckoned among thofe foods which occafion coftivenefs.

Hoffman, in his experiments on milk, found that all kinds of it contained much water; and when this was diffipated, found the refiduum very different in their folubility. But we muft not thence conclude, that the fame infolubility takes place in the ftomach; for extracts made from vegetables with water are often very infoluble fubftances, and hardly diffufible through water itfelf: therefore, in Hoffman's extracts, if we may fo call them, of milk, fomewhat of the fame kind might have appeared; and thefe fubftances, which in their natural ftate were not fo, might appear very infoluble. However, we may allow that milk is always fomehow infoluble in the inteftines, as it is of a drying nature, and as cheefe, &c. is very coftive. And this effect fhows that milk is always coagulated in the ftomach: for if it remained fluid, no fæces would be produced, whereas fometimes very hard ones are obferved. In the blood-veffels, from its animal-nature, it may be confidered as nutritious; but when we confider its vegetable contents, and acefcency in the primæ viæ, we find that, like animal-food, it does not excite that degree of fever in the time of digeftion, and that from its acefcency it will refift putrefaction. Hence its ufe in hectic fevers, which, whatever be their caufe, appear only to be exacerbations of natural feverifh paroxyfms, which occur twice every day, commonly after meals, and at night. To obviate thefe, therefore, we give fuch an aliment as produces the leaft exacerbation of thefe fevers: and of this nature is milk, on account of its acefcent vegetable nature.

There appears alfo fomewhat peculiar to milk, which requires only a fmall exertion of the animal-powers in order to its affimilation; and befides, in hectic complaints there is wanted an oily, bland food, approaching to the animal-nature; fo that on all thefe accounts milk is a diet peculiarly adapted to them, and, in general, to moft convalefcents, and to thofe of inflammatory temperaments. So far of milk in general. We fhall now fpeak of the particular kinds which are in common ufe.

The milk of women, mares, and affes, agree very much in their qualities, being very dilute, having little folid contents, and, when evaporated to drynefs, having thefe very foluble, containing much faccharine matter, of a very ready acefcency, and, when coagulated, their coagulum being tender and eafily broke down. From this view they have lefs oil, and feem to have lefs coagulable matter than the reft.

The milk of cows, fheep, and goats, agree in oppofite qualities to the three juft mentioned; but here there is fomewhat more of gradation. Cows milk comes neareft to the former milk: goats milk is lefs fluid, lefs fweet, lefs flatulent, has the largeft proportion of infoluble part after coagulation, and indeed the largeft proportion of coagulable part; its oily and coagulable parts are not fpontaneoufly feparable, never throwing out a cream, or allowing butter to be readily extracted from it. Hence the virtues of thefe milks are obvious, being more nourifhing, though at the fame time lefs eafily foluble in weak ftomachs, than the three firft, lefs acefcent than thefe, and fo more rarely laxative, and peculiarly fitted for the diet of convalefcents without fever. The three firft again are lefs nourifhing, more foluble, more laxative, as more acefcent, and adapted to the convalefcents with fever.

Thefe qualities, in particular milks, are confiderably diverfified by different circumftances. Firft, Different animals, living on the fame diet, give a confiderably different milk; for there feems to be fomething in the conftitution, abftracting from the aliment, which conftitutes a confiderable diverfity of milk, not only in the fame fpecies of animals, but alfo in the fame animal, at different ages, and at different diftances after delivery: this applies to the choice of nurfes. Secondly, Milk follows the nature of the aliment more than any other juice in the human body, being more or lefs fluid and dilute, more or lefs folid and nourifhing, in proportion as thefe qualities are more or lefs in the aliment. The nature of the aliment differs according to its time of growth, *e. g.* old grafs being always found more nourifhing than young. Aliment, too, is always varied according to the feafon, as that is warm or dry, moift or cloudy.

The milk of each particular kind of animal is fitter for particular purpofes, when fed on proper food.—Thus the cow delights in the fucculent herbage of the vale: if the fheep be fed there he certainly rots, but on the higher and more dry fide of the mountain he feeds pleafantly and healthy; while the goat never ftops near the bottom, but afcends to the craggy fummit: and certainly the milks of thefe animals are always beft on their proper foil, and that of goats is beft on a mountainous country. From a differtation of Linnæus, we have many obfervations concerning the diverfity of plants on which each animal choofes to feed. All the Swedifh plants which could be collected together, were prefented alternately to domeftic animals, and then it appeared that the goat lived on the greateft variety, and even on many which were poifonous to the reft; that the cow chofe the firft fucculent fhoots of the plant, and neglected the fructification; which laft was preferred by the goat. Hence may be deduced rules concerning the pafturage of different animals; *e. g.* Farmers find, that, in a pafture which was only fit to feed a certain number of fheep, an equal number of goats may be introduced, while the fheep are no lefs nourifhed than before.

It is not eafy to affign the difference between milk frefh-drawn and that detained in the open air for fome time: but certainly there is fome material one, otherwife nature univerfally would not have directed infants to fucking; and indeed it feems, better than the other, fitted for digeftion and nourifhment. Phyficians have fuppofed that this depended on the evaporation of fome *fpt. rector*: but our author cannot conceive any fuch, except common water here; and befides, thefe volatile parts can hardly be nutritious. A more plaufible account feems deducible from mixture: milk new-drawn has been but lately mixed, and is expofed to fpontaneous feparation, a circumftance hurtful to digeftion; none of the parts being, by themfelves, fo eafily affimilated as when they are all taken together. Hence, then, milk new-drawn is more intimately blended, and therefore then is moft proper to the weakly and infants.

Another difference in the ufe of milk expofed for fome time to the air, is taking it boiled or unboiled. Phyficians

Milk.

Phyficians have generally recommended the former; but the reafon is not eafily affigned. Perhaps it is this: Milk kept for fome time expofed to the air has gone fo far to a fpontaneous feparation; whereas the heat thoroughly blends the whole, and hence its refolution is not fo eafy in the ftomach; and thus boiled milk is more coftive than raw, and gives more fæces. Again, when milk is boiled, a confiderable quantity of air is detached, as appears from the froth on the furface; and air is the chief inftrument of fermentation in bodies; fo that after this procefs it is not liable to acefcency: for thefe reafons it is proper for the robuft and vigorous.

Another difference of milk is, according as it is fluid or coagulated. The coagulated is of two kinds, as induced by rennet, or the natural acefcency of the milk. The former preparation makes the firmer and lefs eafily foluble coagulum; though, when taken with the whey unfeparated, it is lefs difficult of folution, though more fo than any other coagulum in the fame cafe. Many nations ufe the latter form, which is eafier foluble, but very much acefcent, and therefore, in point of folution, fhould be confined to the vigorous, in point of acefcency, to thofe who live on alkalefcent food; and in the laft cafe, the Laplanders ufe it as their chief acefcent condiment. From the fame confiderations it is more cooling, and in its other effects like all other acefcent vegetables.

Milk by evaporation yields a fweet faline matter, of which Dr Lewis gives the following proportions:

Twelve ounces of	Left of dry matter	From which water extracted a fweet faline fubftance amounting to
Cows milk	13 drams.	$1\frac{1}{2}$ drams.
Goats milk	$12\frac{1}{2}$	$1\frac{1}{4}$
Human milk	8	6
Affes milk	8	6

The faline fubftance extracted from affes milk was white, and fweet as fugar; thofe of the others brown or yellow, and confiderably lefs fweet; that from cows milk had the leaft fweetnefs of any.

On diftilling 12 quarts of milk *in balneo mariæ*, at leaft nine quarts of pure phlegm were obtained: the liquor which afterwards arofe was acidulous, and by degrees grew fenfibly more and more acid as the diftillation was continued. After this came over a little fpirit, and at laft an empyreumatic oil. The remaining folid matter adhered to the bottom of the retort, in the form of elegant fhining black flowers, which being calcined and elixated yielded a portion of fixed alkaline falt.

Milks fet in a warm place, throws up to the furface an unctuous cream, from which, by agitation, the butter is eafily feparated. The addition of alkaline falts prevents this feparation, not (as fome have fuppofed) by abforbing an acid from the milk, but by virtue of their property of intimately uniting oily bodies with watery liquors. Sugar, another grand intermedium betwixt oils and water, has this effect in a greater degree, though that concrete is by no means alkaline, or an abforbent of acids.

The fweet faccharine part of the milk remains diffolved in the whey after the feparation of the curd or cheefy matter, and may be collected from it in a white cryftalline form, by boiling the whey till all remains of the curdled fubftance have fallen to the bottom; then filtering, evaporating to a due confiftence, fetting it to fhoot, and purifying the cryftals by folution in water and a fecond cryftallization. Much has been faid of the medicinal virtues of this fugar of milk, but it does not feem to have any confiderable ones: It is from cows milk that it has been generally prepared; and the cryftals obtained from this kind of milk have but little fweetnefs.

When milk is fuffered to coagulate fpontaneoufly, the whey proves acid, and on ftanding grows more and more fo till the putrefactive ftate commences. Sour whey is ufed as an acid, preferably to the directly vegetable or the mineral acids, in fome of the chemical arts; as for diffolving iron in order to the ftaining of linen and leather. This acid was commonly made ufe of in the bleaching of linen, for diffolving and extracting the earthy particles left in the cloth by the alkaline falts and lime employed for cleanfing and whitening it. Butter-milk is preferred to plain four-milk or four-whey: This laft is fuppofed to give the cloth a yellow colour. Dr Home, in his ingenious treatife on this fubject, recommends water acidulated with fpirit of vitriol (in the proportion of about half an ounce, or at moft three quarters of an ounce, to a gallon), as preferable in many refpects to the acid of milk, or of the more directly vegetable fubftances. He obferves, that the latter are often difficultly procurable, abound with oleaginous particles, and haften to corruption; whilft the vitriolic acid is cheap, and pure, and indifpofed to putrefy: That milk takes five days to perform its office, whilft the vitriolic acid does it in as many hours, perhaps in as many minutes: That this acid contributes alfo to whiten the cloth, and does not make it weaker though the cloth be kept in it for months. He finds, that acids as well as alkalies, extract an oily matter from the cloth, and lofe their acidity and alkalicity. Since this treatife appeared, the ufe of four-milk is very generally fuperfeded by oil of vitriol.

It is obfervable, that affes milk is greatly difpofed, on ftanding for a little time, to become thick and ropy. Iu the Breflau collection for the year 1720, there is a remarkable account of milk (which probably was that of the afs) grown fo thick and tenacious as to be drawn out into long ftrings, which, when dried, were quite brittle.

New cows milk, fuffered to ftand for fome days on the leaves of butterwort or fun-dew, becomes uniformly thick, flippery, and coherent, and of an agreeable fweet tafte, without any feparation of its parts. Frefh milk, added to this, is thickened in the fame manner, and this fucceffively. In fome parts of Sweden, as we are informed in the Swedifh Memoirs, milk is thus prepared for food.

New milk has a degree of glutinous quality, fo as to be ufed for joining broken ftone-ware. There is a far greater tenacity in cheefe properly prepared.

Milk, when examined by a microfcope, appears compofed of numerous globules fwimming in a tranfparent fluid. It boils in nearly the fame degree of heat with common water; fome forts rather fooner, and fome a little later: after boiling, it is lefs difpofed

Milk. pofed to grow four than in its natural ftate. It is coagulated by acids both mineral and vegetable, and by alkalies both fixed and volatile. The coagulum made by acids falls to the bottom of the ferum; that made by alkalies fwims on the furface, commonly forming (efpecially with volatile alkalies) a thick coriaceous fkin. The ferum, with alkalies, proves green or fanious; with acids, it differs little in appearance from the whey that feparates fpontaneoufly. The coagulum formed by acids is diffolved by alkalies, and that formed by alkalies is rediffolved by acids; but the milk does not in either cafe refume its original properties. It is coagulated by moft of the middle falts, whofe bafis is an earth or a metallic body; as folution of alum, fixed fal ammoniac, fugar of lead, green and blue vitriol; but not by the chalybeate or purging mineral waters, nor by the bitter falt extracted from the purging waters. Among the neutral falts that have been tried, there is not one that produces any coagulation. They all dilute the milk, and make it lefs difpofed to coagulate with acids or alkalies: Nitre feems to have this effect in a greater degree than the other neutral falts. It is inftantly coagulated by highly-rectified fpirit of wine, but fcarcely by a phlegmatic fpirit. It does not mingle with expreffed oils. All the coagula are diffolved by gall.

It has generally been fuppofed by medical authors, that the milk of animals is of the fame nature with chyle, and that the human milk always coagulates on the ftomach of infants; but in a late differtation upon the fubject by Mr Clarke, member of the royal Irifh academy, we find both thefe pofitions controverted. According to him, woman's milk, in an healthy ftate, contains no coagulable, mucilaginous, or cheefy principle, in its compofition; or it contains fo little, that it cannot admit of any fenfible proof. Dr Rutty ftates, that it does not afford even a fixth part of the curd which is yielded by cows milk; and Dr Young denies that it is at all coagulable either by rennets or acids. This is confirmed by Dr Ferris, who in 1782 gained the Harveian prize-medal at Edinburgh by a differtation upon milk. Mr Clarke informs us, that he has made a vaft number of experiments upon woman's milk with a view to determine this point. He made ufe of ardent fpirits, all the different acids, infufions of infants ftomachs, and procured the milk of a great many different women; but in no inftance, excepting one or two, did he perceive any thing like curd. This took place in confequence of a fpontaneous acefcency; and only a fmall quantity of foft flaky matter was formed, which floated in the ferum. This he looked upon to be a morbid appearance.

Irifh Tranf. for 1788.

The general opinion that woman's milk is coagulable, has arifen from a fingle circumftance, *viz.* that infants frequently vomit the milk they fuck in a ftate of apparent coagulation. This greatly perplexed Dr Young; who, after having tried in vain to coagulate human milk artificially, concluded, that the procefs took place fpontaneoufly in the ftomach; and that it would always do fo if the milk were allowed to remain in a degree of heat equal to about 96 degrees of Fahrenheit. Mr Clarke took equal quantities of three different kinds of milk, and put them into bottles flightly corked, and thefe bottles into water, the temperature of which was kept up by a fpirit-of-wine lamp as near as poffible to 96° of Fahrenheit: but after frequently examining each bottle during the courfe of the experiment, at the expiration of feveral hours there was not the fmalleft tendency towards coagulation to be perceived in any of them; the cream was only thrown to the furface in a thick and adhefive form, and entirely feparated from the fluid below, which had fomething of a grey and wheyifh appearance. As the matter vomited by infants is fometimes more adhefive than we can fuppofe cream to be, Mr Clarke fuppofed that the curd might be fo entangled with the cream, as to be with difficulty feparated from it; but having collected a quantity of rich cream from the milk of different women, he repeated the experiment with precifely the fame event, not being able in any one inftance to produce the fmalleft quantity of curd. To determine, however, what effects might be produced upon milk by the ftomach of an infant, Mr Clarke made the following experiment: Having taken out the ftomach of a fœtus which had been deprived of life by the ufe of inftruments, he infufed it in a fmall quantity of hot water, fo as to make a ftrong infufion. He added a tea-fpoonful of this infufion to equal quantities of cows and human milk; the confequence of which was, that the cow's milk was firmly coagulated in a fhort time, but the human milk was not altered in the leaft; neither was the leaft coagulation produced by adding a fecond and third fpoonful to the human milk. "Upon the whole, then, (fays Mr Clarke), I am perfuaded it will be found, that human milk, in an healthy ftate, contains little or no curd, and that the general opinion of its nature and properties is founded upon fallacious analogy and fuperficial obfervations made on the matter vomited by infants. We may prefume, that the cream of woman's milk, by its inferior fpecific gravity, will fwim on the furface of the contents of the ftomach; and being of an oily nature, that it will be of more difficult digeftion than any other conftituent part of milk. When an infant then fucks very plentifully, fo as to over-diftend the ftomach, or labours under any weaknefs in the powers of digeftion, it cannot appear unreafonable to fuppofe, that the cream fhall be firft rejected by vomiting. Analogous to this, we know that adults affected with dyfpepfia often bring up greafy fluids from the ftomach by eructation, and this efpecially after eating fat meat. We have, in fome inftances, known this to blaze when thrown into the fire, like fpirit of wine or oil." Our author derives a confirmation of his opinion from the following obfervation, *viz.* that curds vomited by infants of a few days old are yellow, while they become white in a fortnight or three weeks. This he accounts for from the yellow colour of the cream thrown up by the milk of women during the firft four or five days after delivery.

Mr Clarke likewife controverts that common opinion of the human milk being fo prone to acidity, that a great number of the difeafes of children are to be accounted for from that principle. "Whoever (fays he) takes the trouble of attentively comparing human milk with that of ruminant animals, will foon find it to be much lefs prone to run into the acefcent or acid procefs. I have very often expofed equal quantities of human and cows milk in degrees of temperature, varying from the common fummer heat, or 65° to 100°; and

and I have conftantly found that cows milk acquires a greater degree of acidity in 36 hours than the human did in many days: cows milk becomes offenfively putrid in four or five days; a change which healthy human milk, expofed in the fame manner, will not undergo many weeks, nay fometimes in many months. I once kept a few ounces of a nurfe's milk, delivered about fix or feven days, for more than two years in a bottle moderately corked. It ftood on the chimney-piece, and was frequently opened to be examined. At the end of this period it fhowed evident marks of moderate acidity, whether examined by the tafte, fmell, or paper ftained by vegetable blues or purples; the latter it changed to a florid red colour, whereas cows milk kept a few days changed the colour of the fame paper to a green, thereby clearly fhowing its putrefcent tendency."

Our author next goes on to confider of the probability there is of milk becoming fo frequently and ftrongly acid as to occafion moft of the difeafes of infants. He begins with an attempt to fhow, that the phenomena commonly looked upon to be indications of acrimony are by no means certain. Curdled milk has already been fhown to be no fign of acidity; and the other appearance, which has commonly been thought to be fo certain, *viz.* green fæces, is, in the opinion of Mr Clarke, equally fallacious. In fupport of this he quotes a letter from Dr Sydenham to Dr Cole; in which he fays that the green matter vomited by hyfterical women is not any proof of acrid humours being the caufe of that difeafe, for fea-fick people do the fame. The opinion of green fæces being an effect of acidity, proceeds on the fuppofition that a mixture of bile with an acid produces a green colour; but it is found, that the vegetable acid, which only can exift in the human body, is unable to produce this change of colour, though it can be effected by the ftrong mineral acids. As nothing equivalent to any of thefe acids can be fuppofed to exift in the bowels of infants, we muft therefore take fome other method of accounting for the green fæces frequently evacuated by them. "Why fhould four milk, granting its exiftence, give rife to them in infants and not in adults? Have butter milk, fummer-fruits of the moft acefcent kind, lemon or orange juice, always this effect in adults by their admixture with bile? This is a queftion which, I believe, cannot be anfwered in the affirmative."

On the whole, Dr Clarke confiders the difeafe of acidity in the bowels, though fo frequently mentioned, to be by no means common. He owns, indeed, that it may fometimes occur in infancy as well as in adults, from weaknefs of the ftomach, coftivenefs, or improper food; and an indubitable evidence is afforded by fæces which ftain the blue or purple colour of vegetables to a red, though nothing can be inferred with certainty from the colour or fmell.

The Doctor next proceeds to ftate feveral reafons for his opinion, that the greater number of infantile difeafes are not owing to acidity: 1. Woman's milk in an healthy ftate contains little or no coagulable matter or curd. 2. It fhows lefs tendency out of the body to become acefcent than many other kinds of milk. 3. The appearances which have been generally fuppofed to characterife its acidity do not afford fatisfactory evidence of fuch a morbid caufe. 4. Granting this to be the cafe, we have plenty of mild abforbents, capable of deftroying all the acid which can be fuppofed to be generated in the bowels of an infant; yet many children are obferved to die in confequence of thefe difeafes fuppofed to arife from acidity. 5. Tho' the milk of all ruminant animals is of a much more acefcent nature than that of the human fpecies, yet the young of thefe animals never fuffer any thing like the difeafes attributed to acidity in infants. 7. Hiftory informs us, that whole nations ufe four curdled milk as a confiderable part of their food without feeling any inconvenience; which, however, muft have been the cafe, if acidity in the ftomach were productive of fuch deleterious effects as has been fuppofed.

The reafoning of Dr Clarke feems here to be very plaufible, and nothing has as yet been offered to contradict it. The reviewers in taking notice of the treatife only obferve, that the Doctor's pofitions are fupported by great probability; yet "they have feen them, or think they have feen them, contradicted by the appearance of difeafes and the effects of medicines;" fo that they muft leave the fubject to farther examination.

In a memoir by Meffrs Parmentier and Deyeux, members of the royal college of pharmacy, &c. in Paris, we have a great number of experiments on the milk of affes, cows, goats, fheep, and mares, as well as women. The experiments on cows milk were made with a view to determine whether any change was made in the milk by the different kinds of food eaten by the animal. For this purpofe fome were fed with the leaves of *mais* or Turkey wheat; fome with cabbage; others with fmall potatoes; and others with common grafs. The milk of thofe fed with the *mais* or Turkey wheat was extremely fweet; that from the potatoes and common grafs much more ferous and infipid; and that from the cabbages the moft difagreeable of all. By diftillation only eight ounces of a colourlefs fluid were obtained from as many pounds of each of thefe milks; which from thofe who fed upon grafs had an aromatic flavour; a difagreeable one from cabbage; and none at all from the potatoes and Turkey wheat. This liquid became fetid in the fpace of a month whatever fubftance the animal had been fed with, acquiring at the fame time a vifcidity and becoming turbid; that from cabbage generally, but not always, becoming firft putrid. All of them feparated a filamentous matter, and became clear on being expofed to the heat of 25° of Reamur's thermometer. In the refiduums of the diftillations no difference whatever could be perceived. As the only difference therefore exifting in cow's milk lies in the volatile part, our authors conclude, that it is improper to boil milk either for common or medicinal purpofes. They obferved alfo, that any fudden change of food, even from a worfe to a better kind, was attended by a very remarkable diminution in the quantity of milk. All the refiduums of the diftillations yielded, in a ftrong fire, a yellow oil, an acid, a thick and black empyreumatic oil, a volatile alkali, and towards the end a quantity of inflammable air, and at laft a coal remained containing fome fixed alkali with muriatic acid.

On agitating, in long bottles, the creams from the milk of cows fed with different fubftances, all of them

were formed into a kind of half-made butter; of which that formed from the milk from mais was white, firm, and infipid; that from potatoes was fofter and more pinguedinous; but that from common grafs was the beft of all. Cabbage, as in other cafes, gave a ftrong tafte.

In the courfe of their experiments, it was endeavoured to determine whether butter is actually contained in the cream, or whether it be a chemical production of the operation of churning. They could not find any reafon abfolutely fatisfactory on either fide, but incline to the latter opinion; becaufe when cream is allowed to remain among the milk, and the whole curdled promifcuoufly, only fat cheefe, without any butter, is produced. The oily parts cannot be feparated into butter either by acids or any other means than churning: even the artificial mixture of oil with the cream is infufficient for the purpofe.

The ferum of milk was reduced by filtration to a clear and pellucid liquor; and, by mixture with fixed alkali, depofited a portion of cheefy matter which had been diffolved in the whey. The fugar of milk was alfo found in this liquor.

In their experiments upon the milk of various animals, it was found that the milk of affes yielded by diftillation an infipid liquor, and depofited a liquor fimilar to the lymph of cows milk. It is coagulated by all the acids, but not into an uniform mafs, exhibiting only the appearance of diftinct flocculi. It affords but little cream, which is converted with difficulty into a foft butter that foon becomes rancid. It has but a fmall quantity of faccharine particles, and thefe are often mixed with muriatic felenite and common falt. Goats milk has a thick cream, and agreeable to the tafte; and the milk itfelf may be preferved longer in a found ftate than any other fpecies, the fcum on its furface being naturally convertible into palatable cheefe. It is eafily made into firm butter, which does not foon become rancid, and has a good flavour. The butter-milk contains a large quantity of cheefy matter which readily coagulates; but has ftill lefs faccharine matter than that of affes. Sheeps milk can fcarce be diftinguifhed from that of a cow, and eafily parts with its cream by ftanding. It is of a yellow colour, an agreeable flavour, and yields a great proportion of butter; but this is not folid, and foon becomes rancid. Mare's milk is the moft infipid and left nutritious of any; notwithftanding which it has been much recommended for weak and confumptive patients: in which cafes it is probable that it proves efficacious by being more confonant than any other to the debilitated powers of digeftion. It boils with a fmaller fire than any other kind of milk, is eafily coagulated, and the diftilled water does not foon change its nature. It has but a fmall quantity of cheefy matter, and very few oily particles: the cream cannot be made into butter; and the whey contains about as much fugar as cows or goats milk.

In this memoir our authors remark, that in order to augment the quantity, as well as to improve the quality, of the milk of animals, they fhould be well fed, their ftalls kept clean, and their litter frequently renewed: they fhould be milked at ftated hours, but not drained: great attention fhould alfo be paid to the breed; becaufe inferior cattle are maintained at as great expence as the moft valuable kinds. No change ought to be made in the food; though if the milk be employed for medicinal purpofes, it may be improved by a proper mixture of herbs, &c.

In their experiments on woman's milk, Meffrs Parmentier and Deyeux differ fomewhat from Dr Clarke. They firft tried the milk of a woman who had been delivered four months; and obferved, that after the cream had been feparated the other part appeared of a more perfect white, and that it could not be coagulated either by vinegar or mineral acids; which they attributed to a fuperabundance of ferum. But they found that in proportion to the age of the milk it was found to be more eafily coagulable; and this was confirmed by experiments made upon the milk of 20 nurfes. Its coagulability was not increafed by heat. The cream, by agitation, formed a vifcid unctuous matter, but could not be changed into perfect butter: but they found that it was extremely difficult to determine the proportions of the various component parts in human milk, as it differs remarkably, not only in different fubjects, but in the fame fubject at different times. In a nurfe aged about 32 years, who was extremely fubject to nervous affections, the milk was one day found almoft quite colourlefs and tranfparent. In two hours after, a fecond quantity drawn from the breaft was vifcid like the white of an egg. It became whiter in a fhort time, but did not recover its natural colour before the evening. It was afterwards found that thefe changes were occafioned by her having fome violent hyfteric fits in the mean time.

Sugar of Milk. Under the article Chemistry an account has been given of the fugar of milk, with fome of the different methods of making it: but of late we have an account of a method ufed by fome of the Tartar nations of preferving their milk by means of froft; in which operation great quantities of the fugar of milk are accidentally formed. The account was given by Mr Fahrig of Peterfburgh, who undertook a journey, by order of the academy of Peterfburgh, among the Mogul tribes who inhabit the country beyond the lake Baikal, on the banks of the river Salenga. Thefe people allow their milk to freeze in large quantity in iron kettles; and, when it is perfectly congealed, they place them over a gentle fire to foften the edges of the cake, after which it may be taken out with a wooden fpatula. They commence thefe operations at the beginning of the cold, when they have milk in the greateft abundance; after which it may be preferved with great eafe throughout the whole winter. Mr Fahrig having frequent opportunities of feeing thefe cakes, foon obferved, that the furface of them was covered to a confiderable depth with a farinaceous powder; and having eftablifhed a dairy upon the fame plan with thofe of the Moguls, he found the fame thing take place with himfelf. This powder was extremely fweet, and he received platefuls of it from the natives, who ufed it in their food, and fweetened their other victuals with it. Having caufed a number of cakes of frozen milk to be conveyed to the top of his houfe, where they were directly expofed to the violent cold, he found that the feparation of the faccharine powder was greatly promoted by this means. He fcraped the cakes every week to the depth

depth

depth of two inches, and afterwards ſpread out the powder upon an earthen plate in order to deſtroy the remains of moiſture which might have prevented it it from keeping for any length of time. When expoſed in this manner it had a very agreeable and ſtrong ſaccharine taſte; diſſolved in warm water; and when ſtrongly ſtirred by means of a chocolate-ſtick, would at all times produce an excellent and well-taſted milk. Raw milk affords a much larger quantity of this ſaccharine matter than ſuch as has been boiled, or which has had the cream taken off it. Neither muſt the milk be ſuddenly expoſed to the cold before it has loſt its natural heat; for the ſudden contact of the cold drives all the cheeſy and fat part towards the middle, while the external parts conſiſt of little elſe than water. In order to allow the parts of the milk to be all properly mixed together, Mr Fahrig allowed the milk when newly taken from the cows to cool, and then poured it out into ſhallow kettles.

Our author is of opinion that this method of making milk would be of great ſervice to navigators to ſupply themſelves with milk during long ſea-voyages: and he aſſures us, from his own experience, that it will always ſucceed, if proper attention be paid to it. He is of opinion, however, that all countries are not equally proper for the preparation of this ſaccharine matter: and indeed this ſeems very evidently to be the caſe, as the proceſs appears to be a cryſtallization of the ſaccharine parts of the milk, and a ſeparation of them from the aqueous ones by means of extreme cold. The country in which he made the experiments is one of the moſt elevated in all Aſia; and ſo cold, that, though it lies only in the 50th degree of north latitude, its rivers are frozen up for ſix months of the year. A very dry cold wind alſo prevails throughout almoſt the whole year; and the dry winds generally come from the north, being almoſt always preceded by a warm wind from the ſouth, which blows for ſome time. The dry rarefied air increaſes the evaporation from the ice-cakes, and leaves nothing but the ſaccharine or pure conſtituent parts of the milk, which with the addition of water can always recompoſe the fluid.

Milk, in the wine-trade. The coopers know very well the uſe of ſkimmed milk, which makes an innocent and efficacious forcing for the fining down of all white wines, arracks, and ſmall ſpirits; but is by no means to be uſed for red wines, becauſe it diſcharges their colour. Thus, if a few quarts of well-ſkimmed milk be put to a hogſhead of red-wine, it will ſoon precipitate the greater part of the colour, and leave the whole nearly white; and this is of known uſe in the turning red wines, when pricked, into white; in which a ſmall degree of acidity is not ſo much perceived.

Milk is, from this quality of diſcharging colour from wines, of uſe alſo to the wine-coopers, for the whitening of wines that have acquired a brown colour from the caſk, or from having been haſtily boiled before fermenting; for the addition of a little ſkimmed milk, in theſe caſes, precipitates the brown colour, and leaves the wines almoſt limpid, or of what they call a *water whiteneſs*, which is much coveted abroad in wines as well as in brandies.

Milk of Lime; Milk of Sulphur. The name of *milk* is given to ſubſtances very different from *milk* properly ſo called, and which reſemble milk only in colour. Such is water in which quicklime has been ſlaked, which acquires a whiteneſs from the ſmall particles of the lime being ſuſpended in it, and has hence been called the milk of *lime*. Such alſo is the ſolution of liver of *ſulphur*, when an acid is mixed with it, by which white particles of ſulphur are made to float in the liquor.

Milk of Vegetables. For the ſame reaſon that milk of animals may be conſidered as a true animal emulſion, the emulſive liquors of vegetables may be called *vegetable milks*. Accordingly emulſions made with almonds are commonly called *milk of almonds*. But beſides this vegetable milk, which is in ſome meaſure artificial, many plants and trees contain naturally a large quantity of emulſive or milky juices. Such are lettuce, ſpurge, fig-tree, and the tree which furniſhes the elaſtic American reſin. The milky juices obtained from all theſe vegetables derive their whiteneſs from an oily matter, mixed and undiſſolved in a watery or mucilaginous liquor. Moſt reſinous gums were originally ſuch milky juices, which afterwards become ſolid by the evaporation of their moſt fluid and volatile parts.

Theſe natural milky juices have not been examined by any chemiſt. Such an examination would, however, procure much eſſential knowledge concerning vegetable œconomy. We ſhould probably find examples of all kinds of oils reduced into milky juices; and this knowledge cannot fail of throwing much light on the nature of reſins and gum-reſins.

Milk-Fever. See Midwifery, p. 806.

Milky-Hedge, the Engliſh name of a ſhrub growing on the coaſt of Coromandel, where it is uſed for hedging. The whole ſhrub grows very buſhy with numerous erect branches, which are compoſed of cylindrical joints as thick as a tobacco-pipe, of a green colour, and from three to ſix inches long: the joints are thicker than the other parts, but always give way firſt on any accidental violence offered to the plant. When broken it yields a milk of an exceſſively cauſtic quality, which bliſters any part of the ſkin it touches. When the joints are broken off at each end, the tube then contains but very little milk. In this ſtate Mr Ives ventured to touch it with his tongue, and found it a little ſweet. In the hedges it is ſeldom very woody; but when it is, the wood is pretty ſolid, and the bark grey and cracked. This plant, he informs us, has acquired a great reputation in curing the venereal diſeaſe, on the following account. A poor Portugueſe woman, the oldeſt female of her family, had wrought ſurpriſing cures in the moſt inveterate venereal diſorders, even ſuch as the European phyſicians had pronounced incurable. Theſe facts became ſo notorious, that the ſervants of the company, and eſpecially their ſurgeons, were induced to offer her a very conſiderable premium for a diſcovery of the medicine; but ſhe always refuſed to comply, giving for a reaſon, that while it remained a ſecret, it was a certain proviſion for the maintenance of the family in the preſent as well as in future generations. On account of this denial the Engliſh ſurgeons were ſometimes at the pains to have her motions without doors carefully watched; and, as they were not able to diſcover that ſhe ever gathered of any other plant or tree but this, they conjec-

Milky-way Mill. tured that the milk of this tree was the fpecific employed. Mr Ives inquired at the black doctors concerning the virtues of this plant; who all agreed, that it will cure the lues venerea, but differed as to the manner of adminiftering it; fome faying that a joint of it fhould be eaten every morning; others that the milk only fhould be dropped upon fugar; and then put into milk, oil, &c. and given daily to the patient.

Milky-Way. See Astronomy-*Index*.

MILL, a machine for grinding corn, &c. of which there are various kinds, according to the different methods of applying the moving power; as water-mills, wind-mills, mills worked by horfes, &c. See Mechanics, Sect. V.

The firft obvious method of reducing corn into flour for bread would be, by the fimple expedient of pounding. And that was for ages the only one which was practifed by the various defcendants of Adam, and actually continued in ufe among the Romans below the reign of Vefpafian. But the procefs was very early improved by the application of a grinding power, and the introduction of mill-ftones. This, like moft of the common refinements in domeftic life, was probably the invention of the antediluvian world, and certainly practifed in fome of the earlieft ages after it. And, like moft of them, it was equally known in the eaft and weft. Hence the Gauls and Britons appear familiarly acquainted with the ufe of hand-mills before the time of their fubmiffion to the Romans; the Britons particularly diftinguifhing them, as the Highlanders and we diftinguifh them at prefent, by the fimple appellations of *querns*, *carnes*, or *ftones*. And to thefe the Romans added the very ufeful invention of water-mills. For this difcovery the world is pretty certainly indebted to the genius of Italy; and the machine was not uncommon in the country at the conqueft of Lancafhire. This, therefore, the Romans would neceffarily introduce with their many other refinements among us. And that they actually did, the Britifh appellation of a *water-mill* fully fuggefts of itfelf; the *melin* of the Welfh and Cornifh, the *mull*, *meill*, and *melin* of the Armoricans, and the Irifh *muilean* and *muilind*, being all evidently derived from the Roman *mola* and *molendinum*. The fubject Britons univerfally adopted the Roman name, but applied it, as we their fucceffors do, only to the Roman *mill*; and one of thefe was probably erected at every ftationary city in the kingdom. One plainly was at Manchefter, serving equally the purpofes of the town and the accommodation of the garrifon. And one alone would be fufficient, as the ufe of hand-mills remained very common in both, many having been found about the fite of the ftation particularly; and the general practice having defcended among us nearly to the prefent period. Such it would be peculiarly neceffary to have in the camp, that the garrifon might be provided againft a fiege. And the water-mill at Manchefter was fixed immediately below the Caftle-field and the town, and on the channel of the Medlock. There, a little above the ancient ford, the fluice of it was accidentally difcovered about 30 years ago. On the margin of Dyer's-croft, and oppofite to fome new conftructions, the current of the river, accidentally fwelled with the rains, and, obftructed by a dam, broke down the northern bank, fwept away a large oak upon the edge of it, and difclofed a long tunnel in the rock below. This has been fince laid open in part with a fpade. It appeared entirely uncovered at the top, was about a yard in width, and another in depth, but gradually narrowed to the bottom. The fides fhowed every where the marks of the tool on the rock, and the courfe of it was parallel with the channel. It was bared by the flood about 25 yards only in length, but was evidently continued for feveral further; having originally begun, as the nature of the ground evinces, juft above the large curve in the channel of the Medlock.

Whitaker's Hiftory of Manchefter.

For the firft five or fix centuries of the Roman ftate, there were no public bread-bakers in the city of Rome. They were firft introduced into it from the eaft, at the conclufion of the war with Perfeus, and about the year 167 before Chrift. And, towards the clofe of the firft century, the Roman families were fupplied by them every morning with frefh loaves for breakfaft. But the fame cuftom, which prevailed originally among the Romans and many other nations, has continued nearly to the prefent time among the Mancunians. The providing of bread for every family was left entirely to the attention of the women in it. And it was baked upon ftones, which the Welfh denominate *greidiols* and we *gredles*. It appears, however, from the kiln-burnt pottery which has been difcovered in the Britifh fepulchres, and from the Britifh appellation of an *odyn* or *oven* remaining among us at prefent, that furnaces for baking were generally known among the original Britons. An odyn would, therefore, be erected at the manfion of each Britifh baron, for the ufe of himfelf and his retainers. And, when he and they removed into the vicinity of a Roman ftation, the oven would be rebuilt with the manfion, and the public bakehoufes of our towns commence at the firft foundation of them. One bakehoufe would be conftructed, as we have previoufly fhown one mill to have been fet up, for the public fervice of all the Mancunian families. One oven and one mill appear to have been equally eftablifhed in the town. And the inhabitants of it appear immemorially accuftomed to bake at the one and grind at the other. Both, therefore, were in all probability conftructed at the firft introduction of water-mills and ovens into the country. The great fimilarity of the appointments refers the confideration directly to one and the fame origin for them. And the general nature of all fuch inftitutions points immediately to the firft and actual introduction of both. And, as the fame eftablifhments prevailed equally in other parts of the north, and pretty certainly obtained over all the extent of Roman Britain, the fame erections were as certainly made at every ftationary town in the kingdom.

MILL (John), a very learned divine, was born at Shap in Weftmoreland, about the year 1645; and became a fervitor of Queen's college Oxford. On his entering into orders he became an eminent preacher, and was made prebendary of Exeter. In 1681, he was created doctor of divinity; about the fame time he was made chaplain in ordinary to King Charles II. and in 1685 he was elected principal of St Edmund's hall in Oxford. His edition of the Greek Teftament, which will ever render his name memorable, was publifhed about a fortnight before his death, which happened

pened in June 1707. Dr Mills was employed 30 years in preparing this edition.

MILL-STONE, the ftone by which corn is ground.—The mill-ftones which we find preferved from ancient times are all fmall, and very different from thofe in ufe at prefent. Thorefby mentions two or three fuch found in England, among other Roman antiquities, which were but 20 inches broad; and there is great reafon to believe that the Romans, as well as the Egyptians of old, and the ancient Jews, did not employ horfes, or wind, or water, as we do, to turn their mills, but made their flaves and captives of war do this laborious work: they were in this fervice placed behind thefe mill-ftones, and pufhed them on with all their force. Sampfou, when a prifoner to the Philiftines, was treated no better, but was condemned to the mill-ftone in his prifon. The runner or loofe mill-ftone, in this fort of grinding, was ufually very heavy for its fize, being as thick as broad. This is the mill-ftone which is exprefsly prohibited in fcripture to take in pledge, as lying loofe it was more eafily removed. The Talmudifts have a ftory, that the Chaldeans made the young men of the captivity carry mill-ftones with them to Babylon, where there feems to have been a fcarcity at that time; and hence, probably, their paraphrafe renders the text "have borne the mills, or mill-ftones;" which might thus be true in a literal fenfe. They have alfo a proverbial expreffion of a man with a mill-ftone about his neck; which they ufe to exprefs a man under the fevereft weight of affliction. This alfo plainly refers to this fmall fort of ftones.

Rhenifh MILL-STONE, is claffed by Cronftedt among the volcanic products, on account of its appearance, which is a blackifh grey, porous, and perfectly refembling a lava of Mount Vefuvius.

MILLENARIANS, or CHILIASTS, a name given to thofe, in the primitive ages, who believed that the faints will reign on earth with Chrift 1000 years. See MILLENIUM.

MILLENER, or MILLINER, one who fells ribbands and dreffes, particularly head-dreffes, for women; and who makes up thofe dreffes.

Of this word different etymologies have been given. It is not derived from the French; for, through fome ftrange fatality, the French cannot exprefs the notion of *millener*, otherwife than by the circumlocution *marchand* or *marchande des modes*.

Neither is it derived from the Low-Dutch language, the great, but neglected, magazine of the Anglo-Saxon. For Sewell, in his Dictionary Englifh and Dutch, 1708, defcribes *millener* to be "en kraamer van lint en andere optonifelon, Franfche kraamer;" that is, "a pedlar who fells ribbons and other trimmings or ornaments; a French pedlar."

Littleton, in his Englifh and Latin dictionary, publifhed 1677, defines millener, "a jack of all trades;" q. d. *millenarius*, or *mille mercium venditor*; that is, "one who fells a thoufand different forts of things." This etymology feems fanciful: But, if he rightly underftood the vulgar meaning of the word *millener* in his time, we muft hold that it then implied what is now termed "a haberdafher of fmall wares," one who dealt in various articles of petty merchandife, and who did not *make up* the goods which he fold.

Before Littleton's time, however, a fomewhat nicer characteriftic than feems compatible with his notion, appears to have belonged to them; for Shakefpeare, in his Henry IV. makes Hotfpur, when complaining of the daintinefs of a courtier, fay,

"He was *perfumed* like a millener."

The fact feems to be, that there were milleners of feveral kinds: as, *horfe-milleners*, (for fo thofe perfons were called who make ornaments of coloured worfted for horfes); haberdafhers of fmall wares, the *milleners* of Littleton; and *milleners* fuch as thofe now peculiarly known by that name, whether male or female, and to whom Shakefpeare's allufion feems moft appropriate.

Laftly, Dr Johnfon, in his Dictionary, derives the word from *milaner*, an inhabitant of *Milan*, from whence people of this profeffion firft came, as a *Lombard* is a banker.

MILLE PASSUS, or *Millia Paffuum*; a very common expreffion among the ancient Romans for a meafure of diftance, commonly called a *mile*. *Milliarium*, rarely ufed. Which Hefychius made to confift of feven ftadia; Plutarch, little fhort of eight; but many others, as Strabo and Polybius, make it juft eight ftadia. The reafon of this difference feems to be, that the former had a regard to the Grecian foot, which is greater than the Roman or Italic. This diftance is oftentimes called *lapis*, which fee. Each paffus confifted of five feet, (Columella).

MILLENIUM, "a thoufand years;" generally employed to denote the thoufand years, during which, according to an ancient tradition in the church, grounded on fome doubtful texts in the Apocalypfe and other fcriptures, our bleffed Saviour fhall reign with the faithful upon earth after the firft refurrection, before the final completion of beatitude.

Though there has been no age of the church in which the millenium was not admitted by individual divines of the firft eminence, it is yet evident from the writings of Eufebius, Irenæus, Origen, and others among the ancients, as well as from the hiftories of Dupin, Mofheim, and all the moderns, that it was never adopted by the whole church, or made an article of the eftablifhed creed in any nation.

About the middle of the fourth century the millenians held the following tenets:

1ft, That the city of Jerufalem fhould be rebuilt, and that the land of Judea fhould be the habitation of thofe who were to reign on earth 1000 years.

2dly, That the firft refurrection was not to be confined to the martyrs; but that after the fall of Antichrift all the juft were to rife, and all that were on the earth were to continue for that fpace of time.

3dly, That Chrift fhall then come down from heaven, and be feen on earth, and reign there with his fervants.

4thly, That the faints during this period fhall enjoy all the delights of a terreftrial paradife.

Thefe opinions were founded upon feveral paffages of fcripture, which the millenarians among the fathers underftood in no other than a literal fenfe, but which the moderns, who hold that opinion, confider as partly literal and partly metaphorical. Of thefe paffages, that upon which the greateft ftrefs has been laid, we believe to be the following:—"And I faw an angel come down from heaven, having the

key

Millenium. key of the bottomlefs pit, and a great chain in his hand. And he laid hold on the dragon, that old ferpent, which is the devil and Satan, and bound him a *thoufand years*, and caft him into the bottomlefs pit, and fhut him up, and fet a feal upon him, that he fhould deceive the nations no more till *the thoufand years* fhould be fulfilled; and after that he muft be loofed a little feafon. And I faw thrones, and they fat upon them, and judgment was given unto them: and I faw the fouls of them that were beheaded for the witnefs of Jefus, and for the word of God, and which had not worfhipped the beaft, neither his image, neither had received his mark upon their foreheads, or in their hands; and they lived and reigned with Chrift a *thoufand years*. But the reft of the dead lived not again till *the thoufand years were finifhed*. This is the firft refurrection *." This paffage all the ancient millenarians took in a fenfe grofsly literal; and taught, that during the millenium the faints on earth were to enjoy every bodily delight. The moderns, on the other hand, confider the power and pleafure of this kingdom as wholly fpiritual; and they reprefent them as not to commence till after the conflagration of the prefent earth. But that this laft fuppofition is a miftake, the very next verfe except one affures us: for we are there told, that "when the thoufand years are expired, Satan fhall be loofed out of his prifon, and fhall go out to deceive the nations which are in the four quarters of *the earth*;" and we have no reafon to believe that he will have fuch power or fuch liberty in "the new heavens and the *new earth* wherein dwelleth righteoufnefs."

* Rom. xx. 1—6.

For this and other reafons, which our limits will not permit us to enumerate, the moft judicious critics contend, that the prophecies of the millenium point, not to a refurrection of martyrs and other juft men to reign with Chrift a thoufand years in a vifible kingdom upon earth, but to that ftate of the Chriftian church, which, for a thoufand years before the general judgement, will be fo pure and fo widely extended, that, when compared with the ftate of the world in the ages preceding, it may, in the language of fcripture, be called a refurrection from the dead. In fupport of this interpretation they quote two paffages from St Paul, in which a converfion from Paganifm to Chriftianity, and a reformation of life, is called a refurrection from the dead:—"Neither yield ye your members as inftruments of unrighteoufnefs unto fin; but yield yourfelves unto God as thofe that are *alive from the dead* §." And again, "Wherefore he faith, Awake thou that fleepeft, and *arife from the dead*, and Chrift fhall give thee light ‡." It is likewife to be obferved, that in all the defcriptions of the refurrection and future judgement which are given us at fuch length in the gofpels and epiftles, there is no mention made of a *firft* and *fecond* refurrection at the diftance of a thoufand years from each other. There is indeed an order in the refurrection: for we are told †, that "every man fhall rife in his own order; Chrift the firft fruits, afterwards they that are Chrift's at his coming, &c." But were the millenarian hypothefis well founded, the words fhould rather have run thus: "Chrift the firft fruits, then the martyrs at his coming, and a thoufand years afterwards the refidue of mankind. Then cometh the end, &c."

§ Rom. vi. 13.

‡ Eph. v. 14.

† 1 Chron. xv. 23.

Thefe arguments ftrongly incline us to believe, that by the reign of Chrift and the faints for a thoufand years upon earth, nothing more is meant, than that before the general judgment the Jews fhall be converted, genuine Chriftianity be diffufed through all nations, and mankind enjoy that peace and happinefs which the faith and precepts of the gofpel are calculated to confer on all by whom they are fincerely embraced.

Our Saviour's own account of his religion is, that from a fmall beginning it will increafe to the full harveft. The millenium therefore is to be confidered as the full effect of the Chriftian principles in the hearts of men, and over the whole world; and the divines who have treated of this fubject endeavour to prove, that this is to be expected from the facts which have already exifted, and from the importance of the Chriftian doctrine.

1. The gradual progrefs of Chriftianity is no objection to this fact. This is fimilar to the progrefs and advancement from lefs to greater perfection in every thing which poffeffes vegetable or animal life. The fame thing is obferved in the arts, in civilization, in focieties, and in individuals—and why fhould it not be admitted to have place in religion? There is indeed a general principle on which a gradual progreffion, both in the natural and moral world, is founded. The Almighty never employs fupernatural means where the thing can be accomplifhed by thofe which are natural. This idea is of the moft general extent through the whole of the prefent fyftem of nature. The poffibility of another plan could eafily be admitted; but in this cafe there would be a total alteration of every part of the works of God or of man that we are acquainted with. In the fame manner, if the religion of Chrift had been irrefiftible, it would have totally altered its natural confequences. It was neceffary, therefore, from the prefent condition of man, as an active, intelligent, and accountable being, that means fhould be employed; and wherever means are employed, the effects produced muft be gradual, and not inftantaneous.

2. Though the progrefs of a divine revelation be gradual, yet it is to be expected, from the wifdom and compaffion of God, that it will ftill be advancing in the hearts of men, and over the world. In the firft age of the church, the word of God, fupported by miracles, and by the animated zeal of men, who fpake what they faw and heard, grew and prevailed. In this cafe fupernatural means were neceffary, becaufe the prejudices of the world could not be fubdued without them. It was the firft watering of a plant which you afterwards leave to the dew of heaven. Miracles at the fame time were employed only as the means of conviction; and they were not continued, becaufe in this cafe they would have become a conftant and irrefiftible principle, incompatible with the condition of man as a reafonable agent. After this power was withdrawn, there were many ages of ignorance and fuperftition in the Chriftian church. But what is neceffary to be eftablifhed on this fubject is, not that the progrefs of Chriftianity has never been interrupted, but that on the whole it has been advancing. The effects of this religion on mankind, in proportion as it was received, were immediate and vifible;

Millenium. fible: It deftroyed the grofs fuperftition of idol-worfhip: it abolifhed the practice, which was general in the heathen world, of reducing to the loweft ftate of fervitude the greateft part of our brethren; it foftened the horrors of war even when the vices of mankind made defence neceffary; it entered into focial and private life; and taught men benevolence, humanity, and mercy. It is in thefe bleffed effects that we can obferve the progrefs of Chriftianity even to this day. Superftition and idolatry were foon engrafted on the ftem which our Saviour planted in the world; but the fimplicity of the gofpel has been gradually undermining the fabric of fuperftition; and the men who are moft nearly interefted in the deceit are now almoft afhamed to fhow their faces in the caufe. The practice of flavery has, generally fpeaking, been extinguifhed in the Chriftian world; yet the remains of it have been a difgrace to the Chriftian name, and the profeffors of that religion have now begun to fee the inconfiftency. War is not only carried on with lefs animofity, and lefs havoc of the human fpecies; but men begin to cultivate more generally, and to delight in, the arts of peace. The increafing fpirit of charity and benevolence, of which it were eafy to give unexampled inftances in the prefent age, is a decided proof of the increafing influence of Chriftianity. At the fame time, if, inftead of thefe general principles, we were to defcend to private examples of infidelity or of wickednefs, it would be eafy to bring proofs in fupport of an oppofite opinion: but the reafoning would by no means be equally conclufive; for if the general principles by which fociety is regulated be more liberal and merciful, it is evident that there is more goodnefs in a greater number of the human race. Society is nothing more than a collection of individuals; and the general tone, efpecially when it is on the fide of virtue, which almoft in every inftance oppofes the defigns of leading and interefted men, is a certain evidence of the private fpirit. To fhow that this reformation is connected with Chriftianity, it is unneceffary to ftate any comparifon between the influence of heathen and the influence of Chriftian principles; between civilization as depending on the powers of the human underftanding, and on the efficacy of the word of God. The whole of this controverfy may be appealed to an obvious fact, viz. that as any nation has come nearer to the fimplicity of the gofpel in the ftandard of its worfhip, it has been more poffeffed of thofe national virtues which we have afcribed to the influence of Chriftianity. This fact is worth a thoufand volumes of fpeculation on this fubject.

3. A revelation fanctioned by God, for a benevolent purpofe, will be expected to produce effects correfponding to the wifdom which gave it, and to the purpofe for which it is employed. It may be gradual; but it will be increafing, and it muft increafe, to the full harveft. He that has begun the good work will alfo finifh it. It is reafonable to expect this illuftrious fuccefs of the gofpel, both from the nature of the thing, and from the prophecies contained in the facred fcriptures. The precepts of the gofpel, in their genuine fenfe, are admirably calculated for the peace and welfare both of individuals and fociety. The greateft liberality of mind, the greateft generofity of temper, the moft unbounded love, and the greateft indifference to the accumulation of this world's property, if they Millenium. glowed from breaft to breaft, and operated with equal force on all men, would be productive of equal good and happinefs to all. We are fcarcely able to perceive the force of this at firft view, becaufe the deceit and impofition which yet exift in the world, prevent the operation of the beft principles even in the beft hearts. But in proportion to the improvement of mankind, what is their real intereft, and what are the real objects of happinefs, will gradually unfold. The contempt of vice will be greater in proportion to the fcarcity of it: for one villain gives countenance and fupport to another, juft as iron fharpeneth iron. This opens to our view another fact connected with the practice of Chriftianity, namely, that the nearer it arrives to its perfect ftate, it will be the more rapid in its progrefs. The beauty of holinefs will be more vifible; and, in the ftrong language of the prophet, "the earth fhall bring forth in one day, and a nation fhall be born at once *." This future perfection of the gofpel is confiftent with its nature and importance.—We can fcarcely believe that means fo admirably adapted to the reformation of mankind fhould be without their effect; and if the moft difficult part be already accomplifhed, we have no reafon to apprehend that the fcheme will not be completed. This fact is alfo clearly the fubject of ancient prophecy. For "thus faith the Lord †, I will extend peace to her like a river, and the glory of the Gentiles like a flowing ftream. And it fhall come to pafs, from one fabbath to another, and from one new moon to another, fhall all flefh come to worfhip before me, faith the Lord."—"Violence fhall be no more heard in thy land, wafting nor deftruction within thy border; but thou fhalt call thy walls falvation, and thy gates praife." (If. lx. 18.)

* If. lxvi. 8.

† Ver. 12, 23.

Without entering more minutely on the prophecy already quoted from chap. xx. of the book of the Revelation, it is fufficient to obferve, that Dr Whitby, in his treatife on the millenium at the end of his commentary, proves, in the cleareft manner, from the fpirit of the paffage and the fimilarity of the expreffions with thofe of other prophets, that it refers to a ftate of the church for a thoufand years, which fhall be like life from the dead. The commencement of this period is connected with two events; the fall of antichrift, and the converfion of the Jews. The latter of thefe events muft be confidered as a key to all the prophecies concerning the millenium. As the Jews were the ancient people of God, and as their converfion is to be the previous ftep to the general knowledge of Chriftianity, the prophecies of the millenium have a chief relation to this important event. We have already obferved, that God never interpofes with miraculous power to produce what can be effected by natural means; and from what we know of human nature, we cannot but perceive that the converfion of the Jews will powerfully operate to the general converfion of mankind. Freed from thofe prejudices which now make them the objects of hatred in all nations, and fired with that zeal by which new converts are always actuated, they will preach the gofpel with a fervour of which we, who have long been bleffed with its rays, can hardly form a conception; and, by their prefent difperfion over the whole earth, they will be enabled to adapt their inftructions to every individual of the

human race in the language of his fathers. Indeed, if they are not at some future period to be employed by Providence for this purpose, it is difficult, if not impossible to give any reason for their dispersed state and political existence. Just now it must be confessed that they are the most implacable enemies of the Christian name; but their conversion is not on that account more unlikely or improbable than were events which have taken place of nearly equal importance a very few years ago. On the whole, the perfection of Christianity is a doctrine of reasonable expectation to the church; and it is impossible for the advocates for natural religion to deny, that unlimited obedience to its precepts is consistent with the purest state of liberty and of happiness. This is the only millenium which the prophets and apostles, as we understand them, promise to the saints; but as men figuring in the very first ranks of learning have thought otherwise, we would not be too confident that our interpretation is just.—Such of our readers as wish for further information, will find it in the works of Mr Mede, bishop Newton, Dr Whitby, and Dr Gill; and to those masterly writers we refer them for that satisfaction which in such an article as this cannot be given.

MILLEPES, or WOOD-LOUSE, in zoology; a species of ONISCUS. These insects are found in cellars, under stones, and in cold moist places; in the warmer countries they are rarely met with. Millepedes have a faint disagreeable smell, and a somewhat pungent, sweetish, nauseous taste. They have been highly celebrated in suppressions of urine, in all kinds of obstructions of the bowels, in the jaundice, weakness of sight, and a variety of other disorders. Whether they have any just title to these virtues is greatly to be doubted; thus much is certain, that their real effects come far short of the character usually give them.

MILLEPORA, in natural history, a name by which Linnæus distinguishes that genus of lithophytes, of a hard structure and full of holes, which are not stellate or radiated, and whose animal is the hydra, in which it differs from the madrepora, and comprehending 14 different species.

In the millepora, the animal which forms and inhabits it occupies the substance; and it is observed that the milleporæ grow upon one another; their little animals produce their spawn; which attaching itself either to the extremity of the body already formed, or underneath it, gives a different form to this production. Hence the various shapes of the millepora, which is composed of an infinite number of the cells of those little insects, which all together exhibit different figures, though every particular cellula has its essential form, and the same dimensions, according to its own species.

MILLET, in botany. See MILIUM.

MILLIARE, or MILLIARIUM, a Roman mile, which consisted of 100 paces, *mille passus*, whence the name.

MILLIARIUM AUREUM, was a gilded pillar in the forum of Rome, at which all the highways of Italy met, as one common centre. From this pillar the miles were counted, and at the end of every mile a stone was put down. The milliary column was erected by Augustus Cæsar, and, as we are informed by travellers, is still to be seen.

MILLING of CLOTH. See FULLING.

MILLION, in arithmetic, the sum of ten hundred thousand, or a thousand times a thousand. See ARITHMETIC.

MILLO, a part of mount Zion at its extremity; and therefore called *Millo* of the city of David (2 Chron. xxxii.), taken in with the wall that encompassed mount Zion. Uncertain whether *Beth-Millo*, (Judges ix. 20.) denotes a place; if it did, it lay near Sechem.

MILLOT (Claude Francis Xavier), of the French academy, was born at Besançon March 1726, and was for some time a Jesuit. He was consecrated for the pulpit, and continued to preach after he left the society: But the weakness of his voice, his timidity, and the awkwardness of his manner, not permitting him to continue in this profession, he relinquished it, although he had preached Advent sermons at Versailles, and Lent sermons at Luneville. The Marquis de Felino, minister of Parma, instituted an historical class for the benefit of the young nobility; and, at the desire of M. le Duc de Nivernois, he gave the charge of it to the Abbé Millot. The minister having occasioned a kind of rebellion among the people by some innovations which he had made in the state, the Abbé continued attached to the interests of his patron, and would not desert him till the storm was blown over. When he was told that he would lose his place by this conduct, he replied, "My place is with a virtuous persecuted man who has been my benefactor; and that I shall never lose." At length, having filled the historical chair with great approbation, he returned to France, and was appointed preceptor to M. le Duc d'Enghien. In this situation he died, A. D. 1785, aged 59. The Abbé Millot did not shine in company; he was cold and reserved in his manner; but every thing he said was judicious, and exactly in point.—D'Alembert said, that of all his acquaintance the Abbé Millot had the fewest prejudices and the least pretension. He composed several works, which are digested with great care, and written in a pure, simple, and natural style. The principal are, 1. *Elemens de l'Histoire de France, depuis Clovis jusque a Louis XIV.* 3 vols in 12mo. The author, selecting the most curious and important facts, has suppressed every thing foreign to the subject; and has not only arranged the materials in their proper order, but chosen them with the greatest judgment. Querlon thought this the best abridgment which we have of the history of France, and preferred it to that of the President Henault 2. *Elemens de l'Histoire d'Angleterre, depuis son origine sous les Romains, jusqu' à George II.* 3 vols 12mo. In this valuable abridgment, the author satisfies, without tiring, his readers. It is all that is necessary for those who wish to gain a general knowledge of the English history, without entering minutely into its particular parts.—3. *Elemens de l'Histoire Universelle*, 9 vols. 12mo. A certain critic maintains, that this work is merely a counterfeit of Voltaire's general history. But this censure is altogether unjust. The ancient history in this work is wholly composed by the Abbé Millot; and, no less than the modern part, discovers his abilities in the choice of facts, in divesting them of useless circumstances, in relating them without prejudice, and in adorning them with judicious reflections. 4. *L'Histoire*

Millot, Milo. *ſtoire des Troubadours*, 3 vols. 12mo, compiled from the manuſcripts of M. de Sainte-Palaie. This work appears rather tedious, becauſe it treats of men almoſt unknown, and moſt of them deſerving to be ſo. What is there quoted from the Provencal poets is not at all intereſting; and, according to the obſervation of a man of wit, "it ſerves no purpoſe to ſearch curiouſly into a heap of old ruins while we have modern palaces to engage our attention." 5. *Memoirès politiques et Militaires, pour ſervir à l'Hiſtoire de Louis XIV. et de Louis XV.* compoſed from original papers collected by Adrian Maurice duc de Noailles, marſhal of France, in 6 vols 12mo. 6. The Abbé Millot publiſhed alſo ſeveral Diſcourſes, in which he diſcuſſes a variety of philoſophical queſtions, with more ingenuity of argument than fire of expreſſion; and a tranſlation of the moſt ſelect harangues in the Latin hiſtorians; of which it has been remarked, as well as of the orations of the Abbé d'Olivet, that they are coldly correct, and elegantly inſipid. The character of the author, more prudent and circumſpect than lively and animated, ſeldom elevated his imagination above a noble ſimplicity without warmth, and a pure ſtyle without oſtentation. Some of the critics, however, have accuſed him of declamation in ſome parts of his hiſtories, particularly in thoſe parts which concern the clergy. But, in our opinion, the word declamation is totally inapplicable to the writings of the Abbé Millot. He flatters, it is true, neither prieſts nor ſtateſmen; and he relates more inſtances of vicious than of virtuous actions, becauſe the one are infinitely more common than the other: But he relates them coldly; and he appears to be guided more by ſincerity and a love of truth, than by that partial philoſophy which blames the Chriſtian religion for thoſe evils which it condemns.

MILO, a celebrated athlete of Crotona in Italy. His father's name was Diotimus. He early accuſtomed himſelf to carry the greateſt burdens, and by degrees became a prodigy of ſtrength. It is ſaid that he carried on his ſhoulders a young bullock, four years old, for above forty yards; and afterwards killed it with one blow of his fiſt, and eat it up in one day. He was ſeven times crowned at the Pythian games, and ſix at the Olympian. He preſented himſelf a ſeventh time; but no one had the courage or boldneſs to enter the liſts againſt him. He was one of the diſciples of Pythagoras; and to his uncommon ſtrength, it is ſaid, the learned preceptor and his pupils owed their life: The pillar which ſupported the roof of the ſchool ſuddenly gave way; but Milo ſupported the whole weight of the building, and gave the philoſopher and his auditors time to ſcape. In his old age, Milo attempted to pull up a tree by the roots, and break it. He partly effected it; but his ſtrength being gradually exhauſted, the tree when half cleft re-united, and his hands remained pinched in the body of the tree. He was then alone; and, being unable to diſentangle himſelf, he was devoured by the wild beaſts of the place, about 500 years before the Chriſtian æra.

Milo (T. Annius), a native of Lanuvium, who attempted to obtain the conſulſhip at Rome by intrigue and ſeditious tumults. Clodius the tribune oppoſed his views; yet Milo would have ſucceeded but for the following event: As he was going into the country, attended by his wife and a numerous retinue of gladiators and ſervants, he met on the Appian road his enemy Clodius, who was returning to Rome with three of his friends and ſome domeſtics completely armed.—A quarrel aroſe between the ſervants. Milo ſupported his attendants, and the diſpute became general.—Clodius received many ſevere wounds, and was obliged to retire to a neighbouring cottage. Milo purſued his enemy in his retreat, and ordered his ſervants to diſpatch him. The body of the murdered tribune was carried to Rome, and expoſed to public view. The enemies of Milo inveighed bitterly againſt the violence and barbarity with which the ſacred perſon of a tribune had been treated. Cicero undertook the defence of Milo; but the continual clamours of the friends of Clodius, and the ſight of an armed ſoldiery, which ſurrounded the ſeat of judgment, ſo terrified the orator, that he forgot the greateſt part of his arguments, and the defence he made was weak and injudicious.—Milo was condemned, and baniſhed to Maſſilia. Cicero ſoon after ſent his exiled friend a copy of the oration which he had prepared for his defence, in the form in which we have it now; and Milo, after he had read it, exclaimed, *O Cicero, hadſt thou ſpoken before my accuſers in theſe terms, Milo would not be now eating figs at Marſeilles.* The friendſhip and cordiality of Cicero and Milo were the fruits of long intimacy and familiar intercourſe. It was to the ſucceſsful labours of Milo that the orator was recalled from baniſhment, and reſtored to his friends.

MILO, (anciently *Melos*), an iſland in the Archipelago, about 50 miles in circumference, with a harbour, which is one of the largeſt in the Mediterranean. The principal town is of the ſame name as the iſland, and was prettily built, but abominably naſty: the houſes are two ſtories high, with flat roofs; and are built with a ſort of pumice-ſtone, which is hard, blackiſh, and yet very light.

This iſland was formerly rich and populous, From the earlieſt times of antiquity it enjoyed pure liberty. The Athenians, not being able to perſuade the Melians to declare in their favour in the Peloponneſian war, made a deſcent upon the iſland, and attacked them vigorouſly. In two different expeditions they failed of their purpoſe: but returning with more numerous forces, they laid ſiege to Melos; and, obliging the beſieged to ſurrender at diſcretion, put to the ſword all the men who were able to bear arms. They ſpared only the women and children, and theſe they carried into captivity. This act of cruelty puts humanity to the bluſh, and diſgraces the Athenian name. But war was then carried on with a degree of wild rage, unexampled in the preſent times. Republics know not how to pardon, and always carry their vengeance to an extravagant height. When Lyſander, the Lacedemonian general, came to give law to the Athenians, he expelled the colony which they had ſent to Melos, and re-eſtabliſhed the unfortunate remains of its original inhabitants.

This iſland loſt its liberty when Rome, aſpiring to the empire of the world, conquered all the iſles of the Archipelago. In the partition of the empire, it fell to the ſhare of the eaſtern emperors, was governed by particular dukes, and was at laſt conquered by Soliman II. Since that period, it has groaned under the

oke

Milo.

yoke of Turkifh defpotifm, and has loft its opulence and fplendor. At the commencement of the prefent century, it boafted of 17 churches, and 11 chapels, and contained more than 20,000 inhabitants. It was very fertile in corn, wine, and fruits; and the whole fpace from the town to the harbour, which is nearly two miles, was laid out in beautiful gardens. M. Tournefort, who vifited it in the year 1700, gives a fine defcription of it. "The earth, being conftantly warmed by fubterraneous fires, produced almoft without interruption plenteous crops of corn, barley, cotton, exquifite wines, and delicious melons. St Elias, the fineft monaftery in the ifland, and fituated on the moft elevated fpot, is encircled with orange, citron, cedar, and fig trees. Its gardens are watered by a copious fpring. Olive trees, of which there are but few in the other parts of the ifland, grow in great numbers around this monaftery. The adjacent vineyards afford excellent wine. In a word, all the productions of the ifland are the very beft of their kinds; its partridges, quails, kids, and lambs, are highly valued, and yet may be bought at a very cheap price."

* Letters on Greece, Let. 42.

Were M. Tournefort to return to Milo, M. Savary* affures us, he would no longer fee the fine ifland which he has defcribed. "He might ftill fee alum, in the form of feathers, and fringed with filver thread, hanging from the arches of the caverns; pieces of pure fulphur filling the cliffs of the rocks; a variety of mineral fprings; hot baths, (though thefe are now only a fet of fmall dirty caves); the fame fubterraneous fires which in his days warmed the bofom of the earth, and were the caufe of its extraordinary fertility: but inftead of 5000 Greeks, all paying the capitation tax (A), he would now find no more than about 700 inhabitants on an ifland 18 leagues in circumference. He would figh to behold the fineft lands lying uncultivated, and the moft fertile valleys converted into moraffes; of the gardens fcarcely a veftige left; three-fourths of the town in ruins, and the inhabitants daily decreafing. In fhort, during the laft 50 years, Milos has affumed a quite different appearance. The plague, which the Turks propagate every where, has cut off one part of its inhabitants; the injudicious adminiftration of the Porte, and the oppreffive extortions of the Captain Pacha, have deftroyed the reft. At prefent, for want of hands, they cannot cut out a free channel for their waters, which ftagnate in the valleys, corrupt, and infect the air with their putrid exhalations. The falt marfhes, of which there are numbers in the ifland, being equally neglected, produce the fame effects. Add to thefe inconveniences, thofe fulphureous exhalations which arife all over the ifland, and by which the inhabitants of Milos are afflicted with dangerous fevers during three-fourths of the year. Perhaps they may be obliged to forfake their country. Every countenance is yellow, pale, and livid; and none bears any marks of good health. The prudent traveller will be careful to fpend but a very fhort time in this unwholefome conntry, unlefs he choofes to expofe himfelf to the danger of catching a fever. To fleep over-night, or to fpend but one day in the ifland, is often enough to occafion his being attacked with that diftemper.

"Yet (continues our author) a judicious and enlightened government might expel thofe evils which ravage Milos. Its firft care would be to eftablifh a lazaret, and to prohibit veffels whofe crews or cargoes are infected with the plague from landing. Canals might next be cut, to drain the marfhes, whofe exhalations are fo pernicious. The ifland would then be re-peopled. The fulphureous vapours are not the moft noxious. Thefe prevailed equally in ancient times, yet the ifland was then very populous. M. Tournefort, who travelled through it a time lefs diftant from the period when it was conquered by the Turks, and when they had not yet had time to lay it wafte, reckons the number of its inhabitants (as we have faid) at about 20,000. The depopulation of Milos is therefore to be afcribed to the defpotifm of the Porte, and its deteftable police."

Sutherland's Tour up the Straits, p. 146.

The women of Milo, once fo celebrated for their beauty, are now fallow, unhealthy, and difguftingly ugly; and render themfelves ftill more hideous by their drefs, which is a kind of loofe jacket, with a white coat and petticoat, that fcarely covers two-thirds of their thighs, barely meeting the ftocking above the knee. Their hind hair hangs down the back in a number of plaits; that on the fore-part of the head is combed down each fide of the face, and terminated by a fmall ftiff curl, which is even with the lower part of the cheek. All the inhabitants are Greeks, for the Turks are not fond of trufting themfelves in the fmall iflands; but every fummer the captain bafhaw goes round with a fquadron to keep them in fubjection, and to collect the revenue. When the Ruffians made themfelves mafters of the Archipelago during the late war, many of the iflands declared in their favour; but being abandoned by the peace, they were fo feverely mulcted by the Grand Signior, that they have profeffed a determination to remain perfectly quiet in future. As the Turks, however, do not think them worth a garrifon, and will not truft them with arms and ammunition, all thofe which the Ruffians may choofe to invade will be obliged to fubmit. The two points which form the entrance of the harbour, croffing each other, render it imperceptible until you are clofe to it. Thus, while you are perfectly fecure within it, you find great difficulty in getting out, particularly in a northerly wind; and as no trade is carried on except a little in corn and falt, Milo would fcarcely ever be vifited, were it not that, being the firft ifland which one makes in the Archipelago, the pilots have chofen it for their refidence. They live in a little town on the top of a high rock, which, from its fituation and appearance, is called the *Caftle*.—Partridges ftill abound in this ifland; and are fo cheap, that you may buy one for a charge of powder only. The peafants get them by ftanding behind a portable fcreen, with a fmall aperture in the centre, in which they place the muzzle of their piece, and then draw the

(A) Grown up men are the only perfons who pay the capitation tax. Therefore, by adding to the number of 5000 who paid the tax, the women, boys, and girls, we find that Milos, in the days of Tournefort, contained at leaft 20,000 fouls.

Milstone to Miltiades.

the partridges by a call. When a sufficient number are collected, they fire among them, and generally kill from four to seven at a shot: but even this method of getting them is so expensive, from the scarcity of ammunition, that the people can never afford to shoot them, except when there are gentlemen in the island, from whom they can beg a little powder and shot.

Milo is 60 miles north of Candia; and the town is situated in E. Long. 25. 15. N. Lat. 36. 27.

MILSTONE. See Mill-stone.

MILT, in anatomy, a popular name for the Spleen.

Milt, or *Melt*, in natural history, the soft roe in fishes; thus called from its yielding, by expression, a whitish juice resembling milk. See Roe.

The milt is properly the seed or spermatic part of the male fish. The milt of a carp is reckoned a choice bit. It consists of two long whitish irregular bodies, each included in a very thin fine membrane. M. Petit considers them as the testicles of the fish wherein the seed is preserved; the lower part, next the anus, he takes for the *vesiculæ seminales*.

MILTHORP, a port-town of Westmoreland, at the mouth of the Can, five miles from Kendal. It is the only sea-port in the county; and goods are brought hither in small vessels from Grange in Lancashire. Here are two paper-mills. It has a market on Friday, and a fair on Old May-day; and there is a good stone-bridge over the river Betha, which runs through the town.

MILTIADES, an Athenian captain, son of Cypselus. He obtained a victory in a chariot race at the Olympic games. He led a colony of Athenians to the Chersonesus. The causes of this appointment are striking and singular. The Thracian Dolonci, harassed by a long war with the Absynthians, were directed by the oracle of Delphi to take for their king the first man they met in their return home, who invited them to come under his roof and partake his entertainments. This was Miltiades, whom the appearance of the Dolonci, with their strange arms and garments, had struck. He invited them to his house, and was made acquainted with the commands of the oracle. He obeyed; and when the oracle of Delphi had approved a second time the choice of the Dolonci, he departed for the Chersonesus, and was invested by the inhabitants with sovereign power. The first measures he took was to stop the further incursions of the Absynthians, by building a strong wall across the Isthmus. When he had established himself at home, and fortified his dominions against foreign invasion, he turned his arms against Lampsacus. His expedition was unsuccessful; he was taken in an ambuscade, and made prisoner. His friend Crœsus king of Lydia was informed of his captivity, and procured his release. He lived few years after he had recovered his liberty. As he had no issue, he left his kingdom and possessions to Stesagoras the son of Cimon, who was his brother by the same mother. The memory of Miltiades was greatly honoured by the Dolonci, and they regularly celebrated festivals and exhibited shows in commemoration of a man to whom they owed their greatness and preservation.

Miltiades, the son of Cimon, and brother of Stesagoras mentioned in the preceding article, was some time after the death of the latter, who died without issue, sent by the Athenians with one ship to take possession of the Chersonesus. At his arrival Miltiades appeared mournful, as if lamenting the recent death of his brother. The principal inhabitants of the country visited the new governor to condole with him; but their confidence in his sincerity proved fatal to them. Miltiades seized their persons, and made himself absolute in Chersonesus. To strengthen himself, he married Hegesipyla, the daughter of Olorus the king of the Thracians. His triumph was short. In the third year of his government, his dominions were threatened by an invasion of the Scythian Nomades, whom Darius had some time before irritated by entering their country. He fled before them; but as their hostilities were of short duration, he was soon restored to his kingdom. Three years after, he left Chersonesus; and set sail for Athens, where he was received with great applause. He was present at the celebrated battle of Marathon; in which all the chief officers ceded their power to him, and left the event of the battle to depend upon his superior abilities. He obtained an important victory over the more numerous forces of his adversaries. Some time after, Miltiades was intrusted with a fleet of 70 ships, and ordered to punish those islands which had revolted to the Persians. He was successful at first; but a sudden report that the Persian fleet was coming to attack him, changed his operations as he was besieging Paros. He raised the siege, and returned to Athens. He was accused of treason, and particularly of holding correspondence with the enemy. The falsity of these accusations might have appeared, if Miltiades had been able to come into the assembly. But a wound which he had received before Paros detained him at home; and his enemies, taking advantage of his absence, became more eager in their accusations, and louder in their clamours. He was condemned to death; but the rigour of his sentence was retracted on the recollection of his great services to the Athenians, and he was put into prison till he had paid a fine of 50 talents to the state. His inability to discharge so great a sum detained him in confinement; and his wounds becoming incurable, he died a prisoner about 489 years before the Christian era. His body was ransomed by his son Cimon; who was obliged to borrow and pay the 50 talents, to give his father a decent burial.—The accusations against Miltiades were probably the more readily believed by his countrymen, when they remembered how he made himself absolute in Chersonesus; and in condemning the barbarity of the Athenians towards a general, who was the source of their military prosperity, we must remember the jealousy which ever reigns among a free and independent people, and how watchful they are in defence of the natural rights which they see wrested from others by violence. Cornelius Nepos has written the life of Miltiades the son of Cimon; but his history is incongruous and unintelligible, from his confounding the actions of the son of Cimon with those of the son of Cypselus. Greater reliance is to be placed on the narration of Herodotus, whose veracity is confirmed, and who was indisputably better informed and more capable of giving an account of the

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the life and exploits of men who flourifhed in his age, and of which he could fee the living monuments. Herodotus was born about fix years after the famous battle of Marathon; and C. Nepos, as a writer of the Auguftan age, flourifhed about 450 years after the age of the father of hiftory.

MILTON (John), the moft illuftrious of the Englifh poets, was defcended of a genteel family, feated at a place of their own name, viz. *Milton*, in Oxfordfhire. He was born December 9. 1608, and received his firft rudiments of education under the care of his parents, affifted by a private tutor. He afterwards paffed fome time at St Paul's fchool, London; in which city his father had fettled, being engaged in the bufinefs of a fcrivener. At the age of 17, he was fent to Chrift's college, Cambridge; where he made a great progrefs in all parts of academical learning; but his chief delight was in poetry. In 1628, he proceeded bachelor of arts, having performed his exercife for it with great applaufe. His father defigned him for the church; but the young gentleman's attachment to the mufes was fo ftrong, that it became impoffible to engage him in any other purfuits. In 1632, he took the degree of mafter of arts; and having now fpent as much time in the univerfity as became a perfon who determined not to engage in any of the three profeffions, he left the college, greatly regretted by his acquaintance, but highly difpleafed with the ufual method of training up youth there for the ftudy of divinity; and being much out of humour with the public adminiftration of ecclefiaftical affairs, he grew diffatisfied with the eftablifhed form of church-government, and difliked the whole plan of education practifed in the univerfity. His parents, who now dwelt at Horton, near Colnbrook, in Buckinghamfhire, received him with unabated affection, notwithftanding he had thwarted their views of providing for him in the church, and they amply indulged him in his love of retirement; wherein he enriched his mind with the choiceft ftores of Grecian and Roman literature: and his poems of *Comus*, *L'Allegro*, *Il Penferofo*, and *Lycidas*, all wrote at this time, would have been fufficient, had he never produced any thing more confiderable, to have tranfmitted his fame to lateft pofterity. However, he was not fo abforbed in his ftudies as not to make frequent excurfions to London; neither did fo much excellence pafs unnoticed among his neighbours in the country, with the moft diftinguifhed of whom he fometimes chofe to relax his mind, and improve his acquaintance with the world as well as with books.—After five years fpent in this manner, he obtained his father's permiffion to travel for farther improvement.—At Paris he became acquainted with the celebrated Hugo Grotius; and from thence travelling into Italy, he was every where careffed by perfons of the moft eminent quality and learning.

Upon his return home, he fet up a genteel academy in Alderfgate-ftreet.—In 1641, he began to draw his pen in defence of the Prefbyterian party; and the next year he married the daughter of Richard Powell, Efq; of Foreft-Hill in Oxfordfhire. This lady, however, whether from a difference on account of party, her father being a zealous royalift, or fome other caufe, foon thought proper to return to her relations; which fo incenfed her hufband, that he refolved never to take her again, and wrote and publifhed feveral tracts in defence of the doctrine and difcipline of divorce. He even made his addreffes to another lady; but this incident proved the means of a reconciliation with Mrs Milton.

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In 1644, he wrote his Tract upon Education; and the reftraint on the liberty of the prefs being continued by act of parliament, he wrote boldly and nobly againft that reftraint. In 1645, he publifhed his juvenile poems; and about two years after, on the death of his father, he took a fmaller houfe in High Holburn, the back of which opened into Lincoln's-Inn Fields.—Here he quietly profecuted his ftudies, till the fatal cataftrophe and death of Charles I.; on which occafion he publifhed his Tenure of Kings and Magiftrates, in juftification of the fact. He was now taken into the fervice of the commonwealth, and made Latin fecretary to the council of ftate, who refolved neither to write to others abroad, nor to receive any anfwers, except in the Latin tongue, which was common to them all. The famous Ειχων βασιλιχη coming out about the fame time, our author, by command, wrote and publifhed his *Iconoclaftes* the fame year. It was alfo by order of his mafters, backed by the reward of 1000l. that, in 1651, he publifhed his celebrated piece, entitled *Pro Populo Anglicano Defenfio*. "A Defence of the People of England, in anfwer to Salmafius's Defence of the King;" which performance fpread his fame over all Europe.—He now dwelt in a pleafant houfe, with a garden, in Petty France, Weftminfter, opening into St James's Park. In 1652, he buried his wife, who died not long after the delivery of her fourth child; and about the fame time he alfo loft his eye-fight, by a *gutta ferena*, which had been growing upon him many years.

Cromwell took the reigns of government into his own hands in the year 1653; but Milton ftill held his office. His leifure-hours he employed in profecuting his ftudies; wherein he was fo far from being difcouraged by the lofs of his fight, that he even conceived hopes, this misfortune would add new vigour to his genius; which, in fact, feems to have been the cafe.—Thus animated, he again ventured upon matrimony: his fecond lady was the daughter of Captain Woodftock of Hackney: fhe died in childbed about a year after. On the depofition of the protector, Richard Cromwell, and on the return of the long parliament, Milton being ftill continued fecretary, he appeared again in print; pleading for a farther reformation of the laws relating to religion; and, during the anarchy that enfued, he drew up feveral fchemes for re-eftablifhing the commonwealth, exerting all his faculties to prevent the return of Charles II. England's deftiny, however, and Charles's good fortune, prevailing, our author chofe to confult his fafety, and retired to a friend's houfe in Bartholomew-Clofe. A particular profecution was intended againft him; but the juft efteem to which his admirable genius and extraordinary accomplifhments entitled him, had raifed him fo many friends, even among thofe of the oppofite party, that he was included in the general amnefty.

This ftorm over, he married a third wife, Elizabeth, daughter of Mr Minfhall a Chefhrie gentleman; and not

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not long after he took a houſe in the Artillery Walk, leading to Bunhill-Fields. This was his laſt ſtage: here he ſat down for a longer continuance than he had been able to do any where; and though he had loſt his fortune (for every thing belonging to him went to wreck at the Reſtoration), he did not loſe his taſte for literature, but continued his ſtudies with almoſt as much ardour as ever; and applied himſelf particularly to the finiſhing his grand work, the *Paradiſe Loſt;* one of the nobleſt poems that ever was produced by human genius.—It was publiſhed in 1667, and his *Paradiſe Regained* came out in 1670.—This latter work fell ſhort of the excellence of the former production; although, were it not for the tranſcendent merit of Paradiſe Loſt, the ſecond compoſition would doubtleſs have ſtood foremoſt in the rank of Engliſh epic poems. After this he publiſhed many pieces in proſe; for which we refer our readers to the edition of his Hiſtorical, Poetical, and Miſcellaneous Works, printed by Millar, in 2 vols 4to, in 1753.

In 1674, this great man paid the laſt debt to nature at his houſe in Bunhill-fields, in the 66th year of his age; and was interred on the 12th of November, in the chancel of St Giles's, Cripplegate.—A decent monument was erected to his memory, in 1737, in Weſtminſter abbey, by Mr Benſon, one of the auditors of the impreſt.—As to his perſon, it was remarkably handſome; but his conſtitution was tender, and by no means equal to his inceſſant application to his ſtudies.—Though greatly reduced in his circumſtances, yet he died worth 1500 l. in money, beſide his houſehold goods.—He had no ſon; but left behind him three daughters, whom he had by his firſt wife.

MILTON, the name of ſeveral places in England; particularly,

Milton, or *Middleton*, in Dorſetſhire, ſouth-weſt of Blandford, near the road to Dorcheſter, 114 miles from London. It is chiefly noted for its abbey, built by King Athelſtan. The church ſtands near the ſouth ſide of the abbey. It is a large and magnificent pile of Gothic architecture, and contains ſeveral ancient monuments. Here is an alms-houſe for ſix people, who have 12s. a-week, and three yards of cloth for a gown, one pair of ſhoes and ſtockings, and 10s. each on St Thomas's day yearly. Here is a free-ſchool, and a market on Tueſdays.

Milton, in Kent, near Sittinbourn and the Iſle of Sheppey, 6 miles north-weſt of Feverſham, and 40 from London. It is alſo called *Middleton* from its ſituation near the middle of the county, *i. e.* from Deptford to the Downs. The kings of Kent had a palace here, which was caſtellated, and ſtood below the church; but was burnt down in Edward the Confeſſor's time by Earl Godwin, &c. Its church ſtands near a mile off. On approaching the town up the Thames, by the Eaſt-Swale, it ſeems hid among the creeks: yet it is a large town; and has a conſiderable market on Saturdays, and a fair on July 24. The oyſters taken hereabouts are the moſt famous of any in Kent. This town is governed by a portreeve, choſen yearly on St James's-day, who ſupervíſes the weights and meaſures all over the hundred of Milton.

Milton, in Kent, a mile on the eaſt ſide of Graveſend, was incorporated with it in the reign of Queen Elizabeth, by the name of the portreeve, jurats, and inhabitants of the towns of Graveſend and Milton. King Henry VIII. raiſed a platform or block-houſe here, for the defence both of this town and Graveſend, and the command of the river. It has a fair Jan. 25.

Milvius ‖ Mimnermus.

MILVIUS Molvius, or Mulvius, *Pons;* a bridge on the Tiber, built by Æmilius Scaurus the cenſor, in the time of Sylla, at two miles diſtance from the city, on the Via Flaminia, and repaired by Auguſtus. From this bridge the ambaſſadors of the Allobroges were brought back to Rome, by Cicero's management, and made a diſcovery of Catiline's conſpiracy (Salluſt). Near it Maxentius was defeated by Conſtantine (Eutropius). Now called *Ponte Molle*.

Milvius, in ornithology, a ſpecies of Falco.

MIMI, Mimes, in the ancient comedy, were buffoons or mimics, who entertained the people by taking off certain characters, uſing ſuch geſtures as ſuited the perſons or ſubjects they repreſented. There were on the Roman ſtage female performers of this kind called *mimæ*. The word is derived from μιμεομαι, *I imitate*. Some of the *mimi* acted their parts to the ſound of the *tibia;* theſe they called *mimauli*.

Mimi were alſo a kind of farces or ludicrous comedies, generally performed by one perſon. They had no acts, nor any *exordium*.—The *mimi* were introduced upon the Roman ſtage long after comedy and tragedy had arrived at their full perfection. The actor wore no maſk, but ſmeared his face with ſoot, was dreſſed in lambſkin, wore garlands of ivy, and carried a baſket of flowers and herbs, in honour of Bacchus, and diverted the audience with apiſh tricks and ridiculous dances. This was the ſtate of the *mimi* ſoon after their firſt introduction; but they underwent many alterations, which it would take up too much room to relate, and which are not of ſufficient importance to juſtify a detailed account. See Pantomimes.

MIMESIS, in rhetoric, the imitating the voice and geſtures of another perſon.

MIMNERMUS, an ancient poet and muſician, flouriſhed about the beginning of the 6th century B. C. He was of Smyrna, and cotemporary with Solon. Athenæus gives him the invention of pentameter verſe. His elegies, of which only a few fragments are preſerved, were ſo much admired in antiquity, that Horace preferred them to thoſe of Callimachus. He compoſed a poem of this kind, as we learn from Pauſanias, upon the battle fought between the people of Smyrna, and the Lydians, under Gyges. He likewiſe was author of a poem in elegiac verſe, quoted by Strabo, which he entitled *Nanno*, and in which we may ſuppoſe he chiefly celebrated a young and beautiful girl of that name, who, according to Athenæus, was a player on the flute, with whom he was enamoured in his old age. With reſpect to love matters, according to Propertius, his verſes were more valuable than all the writings of Homer.

Plus in amore valet Mimnermi verſus Homero.

Lib. i. Eleg. 9. v. 11.

And Horace bears teſtimony to his abilities, in deſcribing that ſeducing paſſion:

Si Mimnermus uti cenſet, ſine amore jociſque
Nil eſt jucundum, vivas in amore jociſque.

Epiſt. VI. Lib. i. v. 65.

Mimosa.

If, as wise Mimnermus said,
Life unbleſt with love and joy
Ranks us with the ſenſeleſs dead,
Let theſe gifts each hour employ.

Alluding to ſome much admired lines of this Greek poet, which have been preſerved by Stobæus.

Τις δε βιος, τι δε τερπνον ατερ χρυσης Ἀφροδιτης, &c.

What is life and all its pride,
If love and pleaſure be denied?
Snatch, ſnatch me hence, ye fates, whene'er
The am'rous bliſs I ceaſe to ſhare.
Oh let us crop each fragrant flow'r
While youth and vigour give us pow'r:
For frozen age will ſoon deſtroy
The force to give or take a joy;
And then, a prey to pain and care,
Deteſted by the young and fair,
The ſun's bleſt beams will hateful grow,
And only ſhine on ſcenes of wo.

MIMOSA, the SENSITIVE PLANT: A genus of the polygamia order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 33d order, *Lomentaceæ*. The hermaphrodite calyx is quinquedentate; the corolla quinquefid; there are five or more ſtamina, one piſtil, and a legumen: The male calyx is quinquedentate; the corolla quinquefid; with five, ten, or more ſtamina.

The name *mimoſa* ſignifies "mimic;" and is given to this genus on account of the ſenſibility of the leaves, which, by their motion, mimic or imitate, as it were, the motion of animals. See *Sensitive Plant*.

To this genus Linnæus joins many of the *acacias;* and it compriſes near 60 different ſpecies, all natives of warm climates. Of the ſorts cultivated here in our ſtoves, &c. ſome are of the ſhrub and tree kind, and two or three are herbaceous perennials and annuals. The ſenſitive kinds are exceedingly curious plants in the very ſingular circumſtance of their leaves receding rapidly from the touch, and running up cloſe together; and in ſome ſorts the footſtalks and all are affected, ſo as inſtantly to fall downward as if faſtened by hinges, which laſt are called *humble* ſenſitives. They have all winged leaves, each wing conſiſting of many ſmall pinnæ.

In the *Syſtema Vegetabilium*, this genus, including the *mimoſas* properly ſo called, and the *acacias*, is divided into ſeveral ſections, diſtinguiſhed by the figure, ſituation, and arrangement, of the leaves; as, ſimple, ſimply-pinnated, bigeminous and tergeminous, conjugate and pinnated, doubly pinnated. The following are the moſt remarkable

Species, with their properties. 1. The *Senſitiva*, or common ſenſitive humble plant, riſes with an undershrubby prickly ſtem, branching ſix or eight feet high, armed with crooked ſpines; conjugated, pinnated leaves, with bijugated patial lobes or wings, having the inner ones the leaſt, each leaf on a long footſtalk; and at the ſides and ends of the branches many purple flowers in roundiſh heads; ſucceeded by broad, flat, jointed pods, in radiated cluſters.—This is ſomewhat of the humble ſenſitive kind; the leaves, footſtalks and all, receding from the touch, though not with ſuch facility as in ſome of the following ſorts.

2. The *Pudica*, or baſhful humble plant, riſes with an underſhrubby, declinated, prickly ſtem, branching two or three feet around, armed with hairy ſpines; pinnated, digitated leaves, each leaf being of five or more long folioles, attached by their baſe to a long footſtalk, and ſpread out above like the fingers of a hand; and at the ſides and ends of the branches roundiſh heads of greeniſh white flowers, ſucceeded by ſmall jointed prickly pods.—This is truly of the humble ſenſitive kind; for by the leaſt touch the leaves inſtantly recede, contract, cloſe, and together with the footſtalk quickly decline downward, as if aſhamed at the approach of the hand.

3. The *Pernambucana*, or Pernambuca ſlothful mimoſa, has unſhrubby, procumbent, unarmed ſtems, branching two or three feet around; bipinnated leaves, of three or four pair of ſhort, winged foliola; and at the axillas drooping ſpikes of pentandrous flowers, the lower ones caſtrated.—This ſpecies recedes very ſlowly from the touch, only contracting its pinnæ a little when ſmartly touched; hence the name *ſlothful mimoſa.*

4. The *Aſperata*, or Panama ſenſitive plant. Of this curious ſpecies, which has been well deſcribed by Dr Browne (but not figured), there is a good figure in the *Reliquiæ Houſtonianæ* publiſhed by Sir Joſeph Banks. It grows in moiſt places, and by the ſides of rivulets, in the pariſhes of St James and Hanover, Jamaica. It ſeldom riſes above three feet in height; but its ſlender branches extend conſiderably on the neighbouring buſhes. It is armed with crooked, ſharp, ſpines; ſo thickly ſet on the trunk, branches, and leaves, that there is no touching it with ſafety. But the plant has a beautiful appearance; the flowers are yellow and globular, growing at the extremity of the branches. The pods are hairy, brown, and jointed; each containing a ſmall, flat, and brown ſeed. The leaves are numerous, ſmall, and winged: next to thoſe of the mimoſa pudica, they are the moſt irritabile; contracting with the leaſt touch, and remaining ſo for ſeveral minutes after. This ſpecies would form a good hedge or fence round a garden; and by being trimmed now and then by a cutlaſs or gardener's ſciſſars, may be eaſily kept from ſpreading.

5. The *Punctata*, or punctated ſenſitive mimoſa, riſes with a ſhrubby, upright, taper, ſpotted, unarmed ſtem, branching erectly five or ſix feet high; bipinnated leaves, of four or five pair of long winged folioles, having each about 20 pair of pinnæ; and at the axillas and termination of the branches oblong ſpikes of yellowiſh decandrous flowers, the inferior ones caſtrated; ſucceeded above by oblong ſeed-pods. This ſort, though naturally ſhrubby and perennial in its native ſoil, yet in this country it ſometimes decays in winter. It is only ſenſitive in the foliola, but quick in the motion.

6. The *Viva*, lively mimoſa, or ſmalleſt ſenſitive weed, has many creeping roots, and ſpreads itſelf ſo as to cover large ſpots of ground. It riſes at moſt to two inches, has winged leaves, with numerous ſmall pinnæ. The flower is globular, of a bluiſh colour, and grows in cluſters from the axillæ: theſe are followed by little, ſhort, hairy, pods, containing ſmooth ſhining ſeeds. This is the moſt ſenſible of all the mimoſas, the pudica not excepted. By running a ſtick over the plant, a perſon may write his name, and it will remain viſible for ten minutes.

7. The *Quadrivalvis*, perennial, or quadrivalve humble

Mimosa. mimosa, has herbaceous, slender, quadrangular, prickly stems, branching and spreading all around, armed with recurved spines; bipinnated leaves of two or three pair of winged lobes, having each many pinnæ; and at the axillas globular heads of purple flowers, succeeded by quadrivalvular pods. This is of the humble sensitive kind, both leaves and footstalks receding from the touch.

8. The *Plena*, annual, or double-flowered sensitive mimosa, rises with an herbaceous, erect, round, unarmed stem, closely branching and spreading every way, three or four feet high; bipinnated leaves of four or five pair of winged lobes, of many pairs of pinnæ; and at the axillas and termination of the branches spikes of yellow pentandrous flowers, the lower ones double; succeeded by short broad pods. This annual is only sensitive in the foliola, but extremely sensible of the touch or air.

9. The *Cornigera*, or horned Mexican mimosa, commonly called *great horned acacia*, has a shrubby, upright, deformed stem, branching irregularly, armed with very large, horn-like white spines, by pairs, connated at the base; bipinnated leaves thinly placed; and flowers growing in spikes. This species is esteemed a curiosity for the oddity of its large spines, resembling the horns of animals, and which are often variously wreathed, twisted, and contorted.

10. The *Farnesiana*, or fragrant acacia, grows in woodlands and waste lands in most parts of Jamaica; rising to 25 or 30 feet, with suitable thickness. The bark of the trunk is brown and scaly, the branches are alternate. It is adorned with bipinnated leaves of a bright green colour; and yellow globular flowers from the axillæ, of a fragrant smell. The pods are about three inches long, and half an inch broad: they are of a light brown colour, smooth, compressed, and contain five or six smooth flat seeds. Formerly the flowers of this tree were used as an ingredient in the *theriaca andromachi* of the old dispensatories. The tree is sometimes planted for a hedge or fence round inclosures; and the timber, though small, is useful in rural economy.

11. The *Arborea*, or wild tamarind tree, is common in all the woodlands, and especially near where settlements have been made, in Jamaica. It rises to a considerable height, and is proportionably thick. The timber is excellent, and serves many purposes in rural economy: it is of the colour of cedar, pretty hard, and takes a good polish. The leaves are numerous; the flowers globular and white. The pods are about a foot in length, of a fine scarlet colour; when they are ripe they open and become twisted. The seeds then appear; they are oblong, smooth, of a shining black, and quite soft. On the whole, from the leaves, flowers, and pods, this tree exhibits a singular and beautiful contrast. With us this plant is raised in hot-houses; but it appears, that with a little pains it may be made to grow in the open air. A good sizeable tree of this sort grew in the garden of the late Dr William Pitcairn, at Islington, near London.

12. The *Latifolia*, shag-bark, or white wild tamarind. This excellent timber tree is very common in Jamaica, and rises to a moderate height and good thickness. The trunk is rough and scaly: The leaves are numerous, of a rhomboidal figure, and yellowish cast. The flower-spikes are from the axillæ; their colour is yellow. The seed-vessels are flat, jointed, and twisted. The seeds are of the bigness of a vetch, white, and finely streaked with blue. Mimosa.

Of this tree there is a variety which some botanists call *M. serpentina*. The chief difference is in the leaves, which are smaller, and of a shining dark green.

13. The *Lebeck*, or ebony tree. This is a native of the East Indies, but raised from seeds in Jamaica and St Vincent's. It is figured, though not accurately, by Plukenet, Tab. 331. fig. 1. To what height this tree grows, we cannot yet say; but it must be of a considerable thickness if it be the ebony we have in use here. Time will soon determine this, as the few plants in the islands are reared with great care by Dr Dancer in Jamaica, and Mr Alexander Anderson in St Vincent's.

14, 15. The *Cinerea* α:— β *Pinnata?* Cashaw bushes. These species are common about Kingston and Spanish town Jamaica, and rise by slender trunks to about 20 feet. Plate CCCXI. fig. 4.

Dr Roxburgh of Madrass, amongst a number of useful discoveries, has found the lac insect on this species of mimosa *. We have seen the native gum-lac on one of the small twigs, and a specimen of the plant in the collection of a gentleman here. The plant is a variety of the cinerea, and appears rather to be the *M. pinnata*, Lin. It is to be hoped, that in a short time the useful insect just mentioned may be transported from Asia to the West Indies, where this gum, or rather wax, may be also produced.

* See *Asiatic Researches*, Vol. I.

16. The *Scandens*, cacoons, or mafootoo wyth (*Gigalobium scandens*, Browne's Jam. p. 362. *Phaseolus maximus perennis*, Sloane's Cat. 68. *Perein Kaku-valli*, H. M. viii. T. 32, 3, 4.) This species of mimosa is frequent in all the upland valleys and woodlands on the north side of Jamaica. It climbs up the tallest trees, and spreads itself in every direction by means of its *cirrhi* or claspers, so as to form a complete arbour, and to cover the space of an English acre from one root. This circumstance has a bad effect on the trees or bushes so shaded. Light, air, and rain (so necessary for all plants), being shut out, the leaves drop off, the tree gradually rots, and the limbs fall down by the weight of this parasite.

Several authors have mentioned the cacoon; but their descriptions of the plant, and particularly the figures, are erroneous. On that account we have given a figure from the herbarium of a gentleman long resident in Jamaica; and the following are the characters, transcribed from his field notes. Fig. 5.

Folia conjugata. *Petioli* communis longi oppositi *cirrho* terminali. *Pinnæ* quadrijugæ vel duodecim jugæ, oblongæ apice obtusæ nitidæ utrinque glabræ. *Cirrhus* longus contortus apice bifidus. *Spicæ* axillares erectæ, longissimæ, multifloræ floribus parvis, colore viride flavo. *Calyx* quinquedentatus minimus. *Corolla* pentapetala, erecta, parva. *Filamenta* numerosa, è basi corollæ, et eodem longitudine. Antheræ globosæ erectæ. *Stylus* filiformis, tortus, longitudine staminum. *Stigma* simplex. Legumen maximum, lignosum durum, 5 vel 8-pedale longum et 4-5 unciarum latitudine, varie contortum, compressum, bivalve.

 Semina

Mimofa.

Semina plura, circiter decem vel quindecim numero, orbiculata, fubcompreffa, cortice duro, nitido-fufco. *Hilo* nigro breve.

The roots of this plant run fuperficially under the ground or herbage. The trunk is feldom thicker than a man's thigh, and fends off many branches, with numerous fhining green leaves, each of which terminates in a tendril or clafper, that ferves to faften it to trees or bufhes. The flower-fpikes are from the axillæ: they are flender, and the florets on them fmall and numerous. The pod is perhaps the largeft and longeft of any other in the world; being fometimes eight or nine feet in length, five inches broad, jointed, and containing 10 or 15 feeds. Thefe feeds are brown, fhining, flattened, and very hard, and called *cacoons*. They are the fame mentioned in the Philofophical Tranfactions, n° 222. page 298. by Sir Hans Sloane, as being thrown afhore on the Hebrides and Orkneys. This happens in the following manner: The feeds or beans fall into the rivers, and are conveyed to the fea. The trade-winds carries them weftward till they fall into the gulf ftream, which forces them northward along the coaft of America and Bahama iflands. As the winds blow frequent and ftrong from America, thefe feeds are driven to the eaftward, till at length they are thrown afhore and left with the tide as aforefaid.

This bean, after being long foaked in water, is boiled and eaten by fome negroes; but, in general, there feems to be no other ufe made of it than as a fort of fnuff-box.

† *Med. Obf. and Inquir.* Vol. V. p. 151, &c.

17. The *Catechu*, according to Mr Ker †, grows only to 12 feet in height, and to one foot in diameter; it is covered with a thick rough brown bark, and towards the top divides into many clofe branches: the leaves are bipinnated, or doubly winged, and are placed alternately upon the younger branches: the partial pinnæ are nearly two inches long, and are commonly from 15 to 30 pair, having fmall glands inferted between the pinnæ: each wing is ufually furnifhed with about 40 pair of pinnulæ or linear lobes, befet with fhort hairs: the fpines are fhort, recurved, and placed in pairs at the bafes of each leaf: the flowers are hermaphrodite and male, and ftand in clofe fpikes, which arife from the axillæ of the leaves, and are four or five inches long: the calyx is tubular, hairy, and divides at the limb into five oval pointed fegments: the corolla is monopetalous, whitifh, and of the fame form as the calyx, but twice its length: the filaments are numerous, capillary, double the length of the corolla, adhering at the bafe of the germen, and crowned with roundifh antheræ: the germen is oval, and fupports a flender ftyle, which is of the length of the filaments, and terminated by a fimple ftigma: the fruit, or pod, is lance-fhaped, brown, fmooth, compreffed, with an undulated thin margin; it contains fix or eight roundifh flattened feeds which produce a naufeous odour when chewed. From this tree, which grows plentifully on the mountainous parts of Indoftan, where it flowers in June, is produced the officinal drug long known in Europe by the name of *terra japonica*; for the hiftory and preparation of which, fee the article TERRA *Japonica*.

Plate CCCXI. fig. 2.

18. The *Nilotica*, or true Egyptian acacia, rifes to a greater height than the preceding: the bark of the trunk is fmooth, and of a grey colour; that of the branches has commonly a purplifh tinge: the leaves are bipinnated, and placed alternately: the partial pinnæ are oppofite, furnifhed with a fmall gland between the outermoft pair, and befet with numerous pairs of narrow elliptical pinnulæ, or leafits: the fpines are long, white, fpreading, and proceed from each fide of the bafe of the leaves: the flowers are hermaphrodite and male; they affume a globular fhape, and ftand four or five together upon flender peduncles, which arife from the axillæ of the leaves: the calyx is fmall, bell-fhaped, and divided at the mouth into five minute teeth: the corolla confifts of five narrow yellowifh fegments: the filaments are numerous, capillary, and furnifhed with roundifh yellow antheræ: the germen is conical, and fupports a flender ftyle, crowned with a fimple ftigma: the fruit is a long pod, refembling that of the lupin, and contains many flattifh brown feeds. It is a native of Arabia and Egypt, and flowers in July.

Plate CCCXI. fig. 1.

Although the mimofa nilotica grows in great abundance over the vaft extent of Africa, yet gum arabic is produced chiefly by thofe trees, which are fituated near the equatorial regions; and we are told that in Lower Egypt the folar heat is never fufficiently intenfe for this purpofe. The gum exfudes in a liquid ftate from the bark of the trunk and branches of the tree, in a fimilar manner to the gum which is often produced upon the cherry-trees &c. in this country; and by expofure to the air it foon acquires folidity and hardnefs. In Senegal the gum begins to flow when the tree firft opens its flowers; and continues during the rainy feafon till the month of December, when it is collected for the firft time. Another collection of the gum is made in the month of March, from incifions in the bark, which the extreme drynefs of the air at that time is faid to render neceffary. Gum arabic is now ufually imported into England from Barbary; not packed up in fkins, which was the practice in Egypt and Arabia, but in large cafks or hogfheads. The common appearance of this gum is well known; and the various figures which it affumes feem to depend upon a variety of accidental circumftances attending its tranfudation and concretion. Gum Arabic of a pale yellowifh colour is moft efteemed; on the contrary, thofe pieces which are large, rough, of a roundifh figure, and of a brownifh or reddifh hue, are found to be lefs pure, and are faid to be produced from a different fpecies of mimofa *(M. Senegal)*; but the Arabian and Egyptian gum is commonly intermixed with pieces of this kind, fimilar to that which comes from the coaft of Africa near the river Senegal.

Gum-arabic does not admit of folution by fpirit or oil, but in twice its quantity of water it diffolves into a mucilaginous fluid, of the confiftence of a thick fyrup; and in this ftate anfwers many ufeful pharmaceutical purpofes, by rendering oily, refinous, and pinguious fubftances, mifcible with water. The glutinous quality of gum Arabic is preferred to moft other gums and mucilaginous fubftances, as a demulcent in coughs, hoarfeneffes, and other catarrhal affections, in order to obtund irritating acrimonious humours, and to fupply the lofs of abraded mucus. It has been very generally employed in cafes of ardor urinæ and ftrangu-

ary;

Mimosa, Mina. ary: but it is the opinion of Dr Cullen, "that even this mucilage, as an internal demulcent, can be of no service beyond the alimentary canal." See farther the article *Gum Arabic*.

19. The *Senegal* is a native of Guinea, and was some time ago introduced into Jamaica. Dr Wright tells us, he saw both this and the mimosa nilotica, of the size of a cherry tree, growing at Dr Paterson's in the parish of Hanover, Jamaica. The flowers are globular, yellow, and fragrant. The pods are brown, and of the size of a goose-quill. The tree, on being wounded, exsudes gum arabic, though in less quantity, and less transparent, than that of the shops, which is obtained from the *nilotica* above described.

There are above 40 other species characterised in the *Systema Vegetabilium*.

On Plate CCCXII. is figured a new species, of an uncommon size, mentioned by Mr Paterson in his Travels among the Hottentots, but not particularly described. Like several of the other mimosas, it produces gum, which is considered by the natives as a peculiarly delicate species of food: the leaves and lower points of the branches seem to constitute the principal aliment of the camelopardalis; and, from the extent of its boughs, and the smoothness of the trunk, it affords a sufficient defence to a species of gregarious bird against the tribe of serpents and other reptiles which would otherwise destroy its eggs. See the article Loxia.

† *Travels*, Vol. V. p. 34, 35. Mr Bruce † describes two plants which seem referable to this genus; the one named *ergett el dimmo*, the other *ergett el krone*.

The former, in our author's opinion, should be named *mimosa sanguinea*; its name in the Abyssinian language signifying *the bloody ergett*, and derived, as he supposes, from its being partly composed of beautiful pink filaments. When the blossoms are fully spread, the upper part of them consists of yellow curled filaments, and the under part of pink filaments of a similar shape. In its unripe state, that part which afterwards becomes pink is of a green colour, and composed of tubercles of a larger size, and more detached than those which afterwards produce the yellow filaments; the latter being smaller, and closer set together: the leaves are of the double-pinnated kind.

The name of the other species, in the Abyssinian language, signifies *the horned ergett*; which our author supposes to be given it on account of the figure of the pods. The flower very much resembles that of the acacia vera in size and shape, excepting that it is attatched to the branch by a strong woody stalk of considerable length, which grows out at the bottom of the branch bearing the leaves, and is sheltered as in a case by the lower part of it. The branches are all covered with short, strong, and sharp-pointed thorns, having their points inclined backwards towards the root. The pods are covered with a prickly kind of hair, which easily rubs off with the fingers, sticks to them, and gives a very uneasy sensation. They have thirteen divisions; in each of which are three hard, round, and shining seeds, of a dusky brown colour.

Both of these shrubs shut their leaves on the coming on of the violent rains in the wet season, and never fully expand them till the dry season returns.

MINA, or Maneh, a species of money, which properly signifies *one part* or *ounce*. It is observed that this word occurs only in the books of Kings, Chronicles, Ezra, and Ezekiel. This prophet (xlv. 12.) tells us, that the minah or maneh was valued at 60 shekels, which in gold make of our English money about 54½ pounds, and in silver almost seven pounds. Thus for the Hebrew maneh. But the Greek or Attic mina, which is probably that mentioned in the books of the Maccabees and in the New Testament, is valued at 100 drachmæ, or about 2l. 17s. sterling. There was also a lesser mina, which was valued at 75 drachmæ. Minagnghinim ‖ Mindanoa.

MINAGNGHINIM, a pulsatile instrument of music, among the Hebrews, which was a square table of wood, fitted with a handle; over this table was stretched an iron chain, or hempen cord, passing thro' balls of wood or brass, which struck against the table, when the instrument was shook, and occasioned a clear sound, which might be heard at a great distance. See Kircher's figure of it in Plate CCCXIV.

MINCHA, in the Jewish customs, offerings of meal, cakes, or biscuits, made in the temple of the Lord. The Seventy have sometimes preserved this word in their translation; but instead of *mincha* they read *manaa*, which doubtless was the received pronunciation in their time. We find *manaa* in the same sense, in Baruch i. 10. Levit. ii. 3. &c. See the Greek of Jerem. xvii. 26. Dan. ii. 46. 2 Kings viii. 5, 9, xvii. 7. xx. 12. 2 Chron. vii. 7. Nehem. xiii. 5, 9, &c.

MINCHING-hampton, a town of Gloucestershire, 20 miles from Bath and Bristol, and near 90 from London, with a market on Tuesdays, and two fairs. The parish is pretty large, being bounded on the north by the Stroud, and on the south by the brook Avening; and has 12 hamlets belonging to it, with a common called Amberley. Here is a good large rectory church, built in form of a cross, and worth 200l. a-year. Near it are very large camps, with deep trenches; and near Dunkirk in this parish are fulling mills.

MINCIUS, a river of the Transpadana; running from, or rather transmitted through, the Lacus Benacus, from north to south, into the Padus; but originally rising in the Rhetian Alps. Now Mincio or Menzo, running through the duchy of Mantua into the Po.

MIND, a thinking intelligent being, otherwise called *spirit*, in opposition to matter or body. See Metaphysics, Part III.

MINDANOA, or Magindanao, a large island of Asia in the East Indies, and one of the Philippines; 160 miles in length, and 120 in breadth. The interior parts contain several chains of lofty mountains, between which are extensive plains, where vast herds of cattle roam at large in the most delicious pastures. Several deep valleys also intersect, as it were, certain parts of the country, through which, during the rainy seasons, vast torrents pour from the mountains, and force their impetuous way to the sea. The rains and vapours which lodge in the plains diffuse themselves into meandering rivulets, and, collecting a variety of small streams in their course, approach the sea in the form of considerable rivers.—The sovereign of Magindanao is a powerful prince, and has several inferior chiefs, who acknow- *Meares's Voyages.*

acknowledge him as their head. Neverthelefs, there are others of them who refufe fubmiffion to him, and are confequently in a continual ftate of war; fo that peace, at leaft, does not appear to be one of the blef-fings of this ifland. The Spaniards, indeed, affert their right to the entire dominion of Magindanao: but it is mere affertion; for though they have forts, &c. on the ifland, it is by no means in a ftate of fub-jection to their nation.

The air is efteemed falubrious, particularly in the vicinity of the fea. The heat there is not, in any degree, fo intenfe as might be expected in a country which is fituated on the very verge of the torrid zone. The prevalence of the eafterly winds, in that part of the coafts which is wafhed by the Pacific Ocean, renders the air cool and pleafant, the trade-wind blowing inceffantly on its fhores. It acts, indeed, with fo much power as to fweep the whole breadth of the ifland; and though in its paffage it lofes much of its ftrength, it retains a fufficient degree of force to afford refrefhing breezes to the inhabitants of the weftern fhore. The interior parts are much colder, from a very cloudy atmofphere, which frequently hangs over the fummits of the mountains in thick and humid vapours. The foil, which is very exuberant, is fuited to the cultivation of the whole vegetable tribes. Rice is produced in the greateft abundance; a pecul, or 133 pounds, may be purchafed for a Spanifh dollar. Every part of the ifland abounds with buffaloes, cows, hogs, goats, &c. It affords alfo great variety of fowls, and a fpecies of duck, whofe head is of a fine fcarlet colour. Here are alfo a fmall breed of horfes, remarkable for their fpirit. The natives, however, principally employ buffaloes in the various branches of hufbandry and agriculture.

The city of Magindanao is fituated on the fouth-eaft fide of the ifland, has a river capable of admitting fmall veffels, and carries on a confiderable trade with Manilla, Sooloo, Borneo, and the Moluccas. Their exports are rice, tobacco, bees-wax, and fpices; in return for which they receive coarfe cloths of Coromandel, China ware, and opium. The village or town of Samboingan is fituated on the banks of a fmall rivulet, which empties itfelf immediately into the fea, and is agreeably fhaded by groves of cocoa-trees. The number of its inhabitants are about 1000, among which are included the officers, foldiers, and their refpective families. In its environs there are feveral fmall look-out houfes, erected on pofts of twelve feet high, in all of which a conftant guard is kept; fo that it appears as if the Spaniards were in a continual ftate of enmity with the natives. The houfes are built of thofe fimple materials which are of very general ufe in the eaftern feas. They are erected on pofts, and built of bamboo, covered with mats; the lower apartments ferve for their hogs, cattle, and poultry, and the upper ones are occupied by the family."

MINDELHEIM, a town of Germany, in the circle of Suabia, and in Algow, with a caftle. It is capital of a fmall territory between the rivers Iller and Lech, fubject to the houfe of Bavaria. It was taken by the Imperialifts after the battle of Hochftet, who erected it into a principality in favour of the duke of Marlborough; but it returned back to the houfe of Bavaria by the treaty of Raftat. It is 33 miles fouth-eaft of Ulm. E. Long. 10. 40. N. Lat. 48. 5.

Mindelheim, a diftrict of Germany, in Suabia, lying between the bifhopric of Augfburgh and the abbacy of Kempten, which is 20 miles in length and 16 in breadth.

MINDEN, a confiderable town of Germany in the circle of Weftphalia; and capital of a territory of the fame name; feated on the river Wefer, which renders it a trading-place. It belongs to the king of Pruffia, who has fecularized the bifhopric. It is 27 miles eaft-by-fouth of Ofnaburg, and 37 weft of Hanover. E. Long. 9. 5. N. Lat. 52. 22.

Minden (the principality of), in Germany, lies in the circle of Weftphalia, to the north of the county of Ravenfberg, and along each fide of the river Wefer. It is about 32 miles fquare, and Minden and Peterfhagen are the principal places. It was formerly a bifhopric, but is now fecularifed; and was ceded to the elector of Brandenburg by the treaty of Weftphalia.

MINDORA, an ifland of Afia, in the Eaft Indies, and one of the Philippines, 50 miles in circumference, and feparated from Luconia by a narrow channel. It is full of mountains, which abound in palm-trees and all forts of fruits. The inhabitants are idolaters, and pay tribute to the Spaniards, to whom this ifland belongs.

MINE, in natural hiftory, a deep pit under ground, from whence various kinds of minerals are dug out; but the term is more particularly applied to thofe which yield metals. Where ftones only are procured, the appellation of *quarries* is univerfally beftowed upon the places from which they are dug out, however deep they may be.

The internal parts of the earth, as far as they have been yet inveftigated, do not confift of one uniform fubftance, but of various *ftrata* or beds of fubftances, extremely different in their appearances, fpecific gravities, and chemical qualities, from one another. Neither are thefe ftrata fimilar to one another either in their nature or appearance in different countries; fo that even in the fhort extent of half a mile, the ftrata will be found quite different from what they are in another place. As little are they the fame either in depth or folidity. Innumerable cracks and fiffures, by the miners called *lodes*, are found in every one of them; but thefe are fo entirely different in fize and fhape, that it is impoffible to form any inference from their fize in one place to that in another. In thefe lodes or fiffures the metallic ore is met with; and, confidering the great uncertainty of the dimenfions of the lodes, it is evident that the bufinefs of mining, which depends on that fize, muft in like manner be quite uncertain and precarious. Mr Price, in his treatife on the Cornifh mines, obferves, that "the comparative fmallnefs of the largeft fiffures to the bulk of the whole earth is really wonderful. In the fineft pottery we can make, by a microfcopic view, we may difcover numerous cracks and fiffures, fo fmall as to be impenetrable by any fluid, and impervious to the naked eye;" as, by the laws of nature originally impofed by the Creator, it happens that matter cannot contract itfelf into folid large maffes, without leaving fiffures between them, and yet the very fiffures are as neceffary

Mine.

neceffary and ufeful as the ftrata through which they pafs. They are the drains that carry off the redundant moifture from the earth; which, but for them, would be too full of fens and bogs for animals to live or plants to thrive on. In thefe fiffures, the feveral ingredients which form *lodes*, by the continual paffing of waters, and the menftrua of metals, are brought out of the adjacent ftrata, collected and conveniently lodged in a narrow channel, much to the advantage of thofe who fearch for and purfue them; for if metals and minerals were more difperfed, and fcattered thinly in the body of the ftrata, the trouble of finding and getting at them would be endlefs, and the expence of procuring them exceed the value of the acquifition.

The infides of the fiffures are commonly coated over with a hard, cryftalline, earthy fubftance or rind, which very often, in the breaking of hard ore, comes off along with it, and is commonly called the *capels* or *walls* of the lode: but Mr Price is of opinion, that the proper walls of the lode are the fides of the fiffure itfelf, and not the coat juft mentioned, which is the natural plafter upon thofe walls, furnifhed perhaps by the contents of the fiffures, or from oozings of the furrounding ftrata.

The breadth of a lode is eafily known by the diftance betwixt the two incrufted fides of the ftones of ore; and if a lode yields any kind of ore, it is a better fign that the walls be regular and fmooth, or at leaft that one of them be fo, than otherwife; but there are not many of thefe fiffures which have regular walls until they have been funk down fome fathoms.

Thus the inner part of the fiffure in which the ore lies, is all the way bounded by two walls of ftone, which are generally parallel to one another, and include the breadth of the vein or lode. Whatever angle of inclination fome fiffures make in the folid ftrata at their beginning, they generally continue to do the fame all along. Some are very uncertain in their breadth, as they may be fmall at their upper part and wide underneath, and *vice verfa*. Their regular breadth, as well as their depth, is fubject to great variation; for though a fiffure may be many fathoms wide in one particular place, yet a little further eaft or weft it may not perhaps be one inch wide. This exceffive variation happens generally in very compact ftrata, when the vein or fiffure is fqueezed, as it were, through hard rocks which feem to comprefs and ftraiten it. A true vein or fiffure, however, is never entirely obliterated, but always fhows a ftring of metallic ore or of a veiny fubftance; which often ferves as a leader for the miners to follow until it fometimes leads them to a large and richly impregnated part. Their length is in a great meafure unlimited, though not the fpace beft fitted for yielding metal. The richeft ftate for copper, according to Mr Price, is from 40 to 80 fathoms deep; for tin, from 20 to 60; and though a great quantity of either may be raifed at 80 or 100 fathoms, yet "the quality (fays our author) is often too much decayed and dry for metal."

Mr Price informs us, that the fiffures or veins of the Cornifh mines extend from eaft to weft; or, more properly, one end of the fiffure points weft and by fouth, or weft and by north; while the other tends eaft and by fouth, or eaft and by north. Thus they frequently pafs through a confiderable tract of country with very few variations in their directions, unlefs they be interrupted by fome intervening caufe.—But, befides this eaft and weft direction, we are to confider what the miners call the *underlying* or *hade* of the vein or lode; viz. the deflection or deviation of the fiffure from its perpendicular line, as it is followed in depth like the flope of the roof of a houfe, or the defcent of the fteep fide of a hill. This flope is generally to the north or fouth; but varies much in different veins, or fometimes even in the fame vein: for it will frequently flope or underlie a fmall fpace in different ways, as it may appear to be forced by hard ftrata on either fide.—Some of the fiffures do not vary much from a perpendicular, while fome deviate more than a fathom; that is, for every fathom they defcend in perpendicular height, they deviate likewife as much to the fouth or north. Others differ fo much from the perpendicular, that they affume a pofition almoft horizontal; whence they are alfo called *horizontal* or *flat lodes*, and fometimes *lode plots*. Another kind of thefe has an irregular pofition with regard to the reft; widening horizontally for a little way, and then defcending perpendicularly almoft like ftairs, with only a fmall ftring or leader to follow after; and thus they alternately vary and yield ore in feveral flat or horizontal fiffures. This, by the Cornifh tinners, is called (but in Mr Price's opinion erroneoufly) a *floor* or *fquat*; which, properly fpeaking, is a hole or chafm impregnated with metal, making no continued line of direction or regular walls. Neither does a floor of ore defcend to any confiderable depth; for underneath it there appears no fign of a vein or fiffure, either leading directly down or any other way. This kind of vein is very rare in Britain. The fiffures moft common in Britain are the perpendicular and inclined, whether their direction be north or fouth, eaft or weft.

The perpendicular and horizontal fiffures (according to our author) probably remain little altered from their firft pofition, when they were formed at the induration of the ftrata immediately after the waters left the land. The perpendicular fiffures are found more commonly fituated in level ground, at a diftance from hills, and from the fea-fhore; but with regard to the latter, we find that the upper and under maffes of ftrata differ in their folidity and other properties. "Hence, (fays our author) it is very plain, that inclined fiffures owe their deflection or underlie to fome fecondary caufe, violence, or fubfidence, of the earth: for though perpendicular fiffures are feldom to be feen, yet fuch as are inclined at very confiderable depths, become more and more perpendicular as the more central ftrata, by reafon of the vaft fuperincumbent weight, do not feem fo likely to be driven out of their pofition as thofe which lie nearer the furface."

The fiffures are often met with fractured as well as inclined; the reafon of which, in Mr Price's opinion, has been a fubfidence of the earth from fome extraordinary caufe. "The original pofition (fays he) muft have been horizontal, or parallel to the furface of the earth: but we often find thefe ftrata very fenfibly declined from that firft pofition; nay, fometimes

Mine.

times quite reverſed, and changed into perpendicular. When we ſee a wall lean, we immediately conclude that the foundation has given way, according to the angles which the wall makes with the horizon; and when we find the like declination in ſtrata, we may conclude, by parity of reaſon, that there has been a like failure of what ſupported them, in proportion to that declination; or that whatever made the ſtrata to fall ſo much awry, muſt alſo cauſe every thing included in thoſe ſtrata to fall proportionably. Wherever the greateſt ſubſidence is to the north, the top of the lode or fiſſure will point to the north, and of conſequence underlie to the ſouth, and *vice verſa*: the ſlide or heave of the lode manifeſts the greater ſubſidence of the ſtrata; but the ſame lode is frequently fractured and heaved in ſeveral places: all of which, by due obſervation, will ſhow us they were occaſioned by ſo many ſeveral ſhocks or ſubſidencies, and that the ſtrata were not unfooted, ſhaken, or brought to fall once only or twice, but ſeveral times."

Mr Price, in the courſe of his work, obſerves, that though the metallic veins generally run from eaſt to weſt, they are frequently interſected by veins or *lodes*, as he calls them, of other matters, which run from north to ſouth. Some of theſe croſs veins contain lead or antimony, but never tin or copper. Sometimes one of theſe unmetallic veins interſects the true one at right angles, ſometimes obliquely; and ſometimes the mixture of both is ſo intimate, that the moſt expert miners are at a loſs to diſcover the ſeparated part of the true vein. When this laſt is intercepted at right angles, it is moved, either north or ſouth, a very little way, perhaps not more than one fathom; in which caſe, the miners having worked to a ſmall diſtance in one of theſe directions, if they find themſelves diſappointed, turn to the other hand, and ſeldom fail of meeting with what they expected. Sometimes they are directed in their ſearch by the pointing of a rib or ſtring of the true vein; but when the interruption happens in an oblique direction, the difficulty of finding the vein again is much greater.

When two metallic veins in the neighbourhood of each other run in an oblique direction, and of conſequence meet together, they commonly produce a body of ore at the place where they interſect; and if both are rich, the quantity will be conſiderable; but if one be poor and the other rich, then both are either enriched or impoveriſhed by the meeting. After ſome time they ſeparate again, and each will continue its former direction near to the other; but ſometimes, though rarely, they continue united.

It is a ſign of a poor vein when it ſeparates or diverges into ſtrings; but, on the contrary, when ſeveral of them are found running into one, it is accounted a promiſing ſign. Sometimes there are branches without the walls of the vein in the adjacent ſtrata, which often come either obliquely or tranſverſely into it. If theſe branches are impregnated with ore, or if they underlie faſter than the true vein, that is, if they dip deeper into the ground, then they are ſaid to overtake or come into the lode, and to enrich it; or if they do not, then they are ſaid to go off from it, and to impoveriſh it. But neither theſe nor any other marks either of the richneſs or poverty of a mine are to be entirely depended upon; for many mines, which have a very bad appearance at firſt, do nevertheleſs turn out extremely well afterwards; while others, which in the beginning ſeemed very rich, turn gradually worſe and worſe: but in general, where a vein has a bad appearance at firſt, it will be imprudent to be at much expence with it.

Veins of metal, as has been already obſerved, are frequently, as it were, ſo compreſſed betwixt hard ſtrata, that they are not an inch wide; nevertheleſs, if they have a ſtring of good ore, it will generally be worth while to purſue them; and they frequently turn out well at laſt, after they have come into ſofter ground. In like manner, it is an encouragement to go on if the branches or leaders of ore enlarge either in width or depth as they are worked; but it is a bad ſign if they continue horizontal without inclining downwards; though it is not proper always to diſcontinue the working of a vein which has an unfavourable aſpect at firſt. Veins of tin are worth working when only three inches wide, provided the ore be good; and copper ores when ſix inches wide will pay very well for the working. Some of the great mines, however, have very large veins, with a number of other ſmall ones very near each other. There are alſo veins croſſing one another ſometimes met with, which are called *contras*, vulgarly *caunters*. Sometimes two veins run down into the ground in ſuch a manner that they meet in the direction of their depth; in which caſe, the ſame obſervations apply to them which are applicable to thoſe that meet in an horizontal direction. Sometimes a vein will ſuddenly diſappear without giving any warning, by becoming narrower, or of worſe quality; which by the miners is called a *ſtart* or *leap*, and is very common in the mines of Cornwall. In one day's time they may thus be diſappointed in the working of a rich vein of tin, and have no further ſign of any thing to work upon: at the fractured extremity of their vein they perceive a body of clay or other matter; and the method of recovering their vein is to drive on their work in the direction of the former part, ſo that their new work ſhall make the ſame angle with the clay that the other part of the vein does. Sometimes they ſink a ſhaft down from the ſurface; but it is generally a matter of difficulty to recover a vein when thus loſt.

The method of diſcovering mines is a matter of ſo much difficulty, that it ſeems ſurpriſing how thoſe who were totally unacquainted with the nature of metals firſt came to think of digging them out of the earth. According to Lucretius, the diſcovery was made by the conflagration of certain woods, which melted the veins of metal in the earth beneath them; but this ſeems to be rather improbable. Ariſtotle, however, is of the ſame opinion with Lucretius, and tells us, that ſome ſhepherds in Spain having ſet fire to the woods, the earth was thus heated to ſuch a degree, that the ſilver near the ſurface of it melted and flowed into a maſs; and that in a ſhort time the metallic maſs was diſcovered by the rending of the earth in the time of an earthquake: and the ſame ſtory is told by Strabo, who aſcribes the diſcovery of the mines of Andaluſia to this accident. Cadmus is ſaid by ſome to have been the firſt who diſcovered gold: while others aſcribe this to Thoas the Thracian, to Mercury the ſon of Jupiter, or to Piſus king of

of Italy; who having left his own country, went into Egypt, where he was elected king after the death of Mizraim the son of Ham; and, on account of his discovery, was called the *Golden God*. Others say, that *Eaclis* or Cæacus the son of Jupiter, or Sol the son of Oceanus, was the first discoverer; but Æschylus attributes the discovery not only of gold, but of all other metals, to Prometheus. The brass and copper mines in Cyprus were first discovered by Cinyra the son of Agryopa; and Hesiod ascribes the discovery of the iron mines of Crete to the Cretan Dactyli Idæi. The extraction of lead or tin from its ore in the island of Cassiteris, according to several ancient authors, was discovered by Midacritus.—The scripture, however, ascribes the invention of brass and iron, or at least of the methods of working them, to Tubal Cain before the flood.

In more modern times, we know that mines have been frequently discovered by accident; as in sea-cliffs, among broken craggy rocks, by the washing of the tides or floods, also by irruptions and torrents of water issuing out of hills and mountains, and sometimes by the wearing of high roads. Mr Price mentions another way by which mines have been discovered, *viz.* by fiery coruscations; which, he says, he has heard from persons whose veracity he is unwilling to question. "The tinners (says he) generally compare these effluvia to blazing stars or other whimsical likenesses, as their fears or hopes suggest; and search with uncommon eagerness the ground over which these jack-a-lanterns have appeared and pointed out. We have heard but little of these phenomena for many years; whether it be, that the present age is less credulous than the foregoing, or that the ground, being more perforated by innumerable new pits sunk every year, some of which, by the stannary laws, are prevented from being filled up, has given these vapours a more gradual vent, it is not necessary to inquire, as the fact itself is not generally believed."

Mines, however, are now most commonly discovered by investigating the nature of such veins, ores, and stones, as may seem most likely to turn to account: but there is a particular sagacity, or habit of judging from particular signs, which can be acquired only by long practice. Mines, especially those of copper, may also be discovered by the harsh and disagreeable taste of the waters which issue from them; though it is probable that this only happens when the ore lies above the level of the water which breaks out; for it does not seem likely that the taste of the ore could *ascend*, unless we were to suppose a pond or lake of water standing above it. The presence of copper in any water is easily discovered by immerging in it a bit of polished iron, which will thus instantly be turned of a copper colour, by reason of the precipitation of the metal upon it. A candle, or piece of tallow put into water of this kind, will in a short time be tinged of a green colour.

Another and still more remarkable method of discovering mines is said to be by the *virgula divinatoria*, or "divining rod;" which, however incredible the stories related concerning it may be, is still relied on by some, and among others by Mr Price. It is not known who was the inventor of this method; but Agricola supposes that it took its rise from the magicians, who pretended to discover mines by inchantment. No mention is made of it, however, before the 11th century, since which time it has been in frequent use; and the Corpuscular Philosophy has even been called in to account for it. But before we pretend to account for phenomena so very extraordinary as those reported of the *virgula divinatoria*, it is necessary, in the first place, to determine whether or not they exist. Mr Price, as has been already hinted, believes in it, though he owns that by reason of his constitution of mind and body he is almost incapable of co-operating with its influence. The following account, however, he gives from Mr William Cookworthy of Plymouth, a gentleman of known veracity and great chemical abilities.

He had the first information concerning this rod from one Captain Ribeira, who deserted from the Spanish service in Queen Anne's reign, and became captain-commandant in the garrison of Plymouth; in which town he satisfied several intelligent persons of the virtues of the rod, by many experiments on pieces of metal hid in the earth, and by an actual discovery of a copper mine near Oakhampton, which was wrought for some years. This captain very readily showed the method of using the rod in general, but would not by any means discover the secret of distinguishing the different metals by it; though, by a constant attention to his practice, Mr Cookworthy discovered it. Captain Ribeira was of opinion, that the only proper rods for this purpose were those cut from the nut or fruit-trees; and that the virtue was confined to certain persons, and those, comparatively speaking, but few: but Mr Price says, that the virtue resides in all persons and in all rods under certain circumstances. "The rod (says he) is attracted by all the metals, by coals, limestone, and springs of water, in the following order: 1. Gold; 2. Copper; 3. Iron; 4. Silver; 5. Tin; 6. Lead; 7. Coals; 8. Limestone and springs of water. One method of determining the different attractions of the rod is this: Stand, holding the rod with one foot advanced; put a guinea under that foot, and an halfpenny under the other, and the rod will be drawn down; shift the pieces of money, and the rod will be drawn towards the face, or backwards to the gold, which proves the gold to have the stronger attraction.

"The rods formerly used were shoots of one year's growth that grew forked; but it is found, that two separate shoots tied together with packthread or other vegetable substance answer rather better than such as are naturally forked, as the shoots of the latter are seldom of an equal size. They are to be tied together by the greater ends, the small ones being held in the hands. Hazle rods cut in the winter, such as are used for fishing rods, and kept till they are dry, do best; though, where these are not at hand, apple-tree suckers, rods from peach-trees, currants, or the oak, though green, will answer tolerably well."

Our author next proceeds to describe the manner of holding the rod; of which he gives a figure, as he says it is difficult to be described. The small ends being crooked, are to be held in the hands in a position flat or parallel to the horizon, and the upper part in an elevation not perpendicular to it, but at an angle of about 70 degrees. "The rod (says he) being pro-

 F perly

perly held by thofe with whom it will anfwer, when the toe of the right foot is within the femidiameter of the piece of metal or other fubject of the rod, it will be repelled towards the face, and continue to be fo while the foot is kept from touching or being directly over the fubject; in which cafe it will be fenfibly and ftrongly attracted, and be drawn quite down. The rod fhould be firmly and fteadily grafped; for if, when it has begun to be attracted, there be the leaft imaginable jerk or oppofition to its attraction, it will not move any more till the hands are opened, and a frefh grafp taken. The ftronger the grafp the livelier the rod moves, provided the grafp be fteady and of an equal ftrength. This obfervation is very neceffary; as the operation of the rod in many hands is defeated purely by a jerk or counteraction: and it is from thence concluded, that there is no real efficacy in the rod, or that the perfon who holds it wants the virtue: whereas, by a proper attention to this circumftance in ufing it, five perfons in fix have the virtue, as it is called; that is, the nut or fruit-bearing rod will anfwer in their hands. If a rod, or the leaft piece of one of the nut-bearing or fruit kind, be put under the arm, it will totally deftroy the operation of the *virgula divinatoria*, in regard to all the fubjects of it, except water, in thofe hands in which the rod naturally operates. If the leaft animal thread, as filk, or worfted, or hair, be tied round or fixed on the top of the rod, it will in like manner hinder its operation; but the fame rod placed under the arm, or the fame animal fubftances tied round or fixed on the top of the rod, will make it work in thofe hands, in which without thefe additions it is not attracted."

Such are the accounts of this extraordinary rod, to which it is probable that few will affent; and we believe the inftances of mines having been difcovered by it are but very rare. Another and very ancient mode of difcovering mines, lefs uncertain than the divining rod, but extremely difficult and precarious, is that called *fhodeing*; that is, tracing them by loofe ftones, fragments, or *fhodes*, which may have been feparated and carried off to a confiderable diftance from the vein, and are found by chance in running waters, on the fuperficies of the ground, or a little under. "When the tinners (fays Mr Price) meet with a loofe fingle ftone of tin ore, either in a valley or in ploughing or hedging, though at 100 fathoms diftance from the vein it came from, thofe who are accuftomed to this work will not fail to find it out. They confider, that a metallic ftone muft originally have appertained to fome vein, from which it was fevered and caft at a diftance by fome violent means. The deluge, they fuppofe, moved moft of the loofe earthy coat of the globe, and in many places wafhed it off from the upper towards the lower grounds, with fuch a force, that moft of the backs or lodes of veins which protruded themfelves above the faft were hurried downwards with the common mafs: whence the fkill in this part of their bufinefs lies much in directing their meafures according to the fituation of the furface." Afterwards, however, our author complains, that this art of *fhoding*, as he calls it, is in a great meafure loft.

The following account of a method of finding filver mines by Alonzo Barba feems to be fimilar to that of fhoding juft now mentioned. "The veins of metal (fays he) are fometimes found by great ftones above ground; and if the veins be covered, they hunt them out after this manner; *viz.* taking in their hands a fort of mattock, which has a fteel point at one end to dig with, and a blunt head at the other wherewith to break ftones, they go to the hollows of the mountains, where the current of rain water defcends, or to fome other part of the fkirts of the mountains, and there obferve what ftones they meet with, breaking in pieces thofe that feem to have any metal in them; whereof they find many times both middling fort of ftones and fmall ones alfo of metal. Then they confider the fituation of that place, and whence thefe ftones can tumble, which of neceffity muft be from higher ground, and follow the tract of them up the hill as long as they can find any of them," &c.

"Another way (fays Mr Price) of difcovering lodes is by working drifts acrofs the *country*, as we call it, that is, from north to fouth, and *vice verfa*. I tried the experiment in an adventure under my management, where I drove all open at grafs about two feet in the fhelf, very much like a level to convey water upon a mill wheel: by fo doing I was fure of cutting all lodes in my way; and did accordingly difcover five courfes, one of which has produced above 180 tons of copper ore, but the others were never wrought upon. This method of difcovering lodes is equally cheap and certain; for 100 fathoms in fhallow ground may be driven at 50s. expence."

In that kind of ground called by our author *feafible*, and which he explains by the phrafe *tender-ftanding*, he tells us, that "a very effectual, proving, and confequential way is, by driving an adit from the loweft ground, either north or fouth; whereby there is a certainty to cut all lodes at 20, 30, or 40 fathoms deep, if the level admits of it. In driving adits or levels acrofs, north or fouth, to unwater mines already found, there are many frefh veins difcovered, which frequently prove better than thofe they were driving to."

After the mine is found, the next thing to be confidered is, whether it may be dug to advantage. In order to determine this, we are duly to weigh the nature of the place, and its fituation, as to wood, water, carriage, healthinefs, and the like; and compare the refult with the richnefs of the ore, the charge of digging, ftamping, wafhing, and fmelting.

Particularly the form and fituation of the fpot fhould be well confidered. A mine muft either happen, 1. In a mountain; 2. In a hill; 3. In a valley; or, 4. In a flat. But mountains and hills are dug with much greater eafe and convenience, chiefly becaufe the drains and burrows, that is, the adits or avenues, may be here readily cut, both to drain the water and to form gang-ways for bringing out the lead, &c. In all the four cafes, we are to look out for the veins which the rains or other accidental thing may have laid bare; and if fuch a vein be found, it may often be proper to open the mine at that place, efpecially if the vein prove tolerably large and rich: otherwife the moft commodious place for fituation is to be chofen for the purpofe, *viz.* neither on a flat, nor on the tops of mountains, but on the fides. The beft fituation for a mine, is a mountainous, woody, wholefome fpot; of a fafe eafy afcent, and bordering on a navigable river. The

The places abounding with mines are generally healthy, as ſtanding high, and every where expoſed to the air; yet ſome places where mines are found prove poiſonous, and can upon no account be dug, though ever ſo rich: the way of examining a ſuſpected place of this kind, is to make experiments upon brutes, by expoſing them to the effluvia or exhalations to find the effects.

Devonſhire and Cornwall, where there are a great many mines of copper and tin, is a very mountainous country, which gives an opportunity in many places to make adits or ſubterraneous drains to ſome valley at a diſtance, by which to carry off the water from the mine, which otherwiſe would drown them out from getting the ore. Theſe adits are ſometimes carried a mile or two, and dug at a vaſt expence, as from 2000l. to 4000l. eſpecially where the ground is rocky; and yet they find this cheaper than to draw up the water out of the mine quite to the top, when the water runs in plenty and the mine is deep. Sometimes, indeed, they cannot find a level near enough to which an adit may be carried from the very bottom of the mine; yet they find it worth while to make an adit at half the height to which the water is to be raiſed, thereby ſaving half the expence.

The late Mr Coſtar, conſidering that ſometimes from ſmall ſtreams, and ſometimes from little ſprings or collections of rain-water, one might have a good deal of water above ground, though not a ſufficient quantity to turn an overſhot-wheel, thought, that if a ſufficient fall might be had, this collection of water might be made uſeful in raiſing the water in a mine to the adit, where it may be carrried off.

But now the moſt general method of draining mines is by the ſteam-engine. See *Steam-Engine.*

Mine, in the military art, denotes a ſubterraneous canal or paſſage, dug under the wall or rampart of a fortification, intended to be blown up by gunpowder.

The alley or paſſage of a mine is commonly about four feet ſquare; at the end of this is the chamber of the mine, which is a cavity of about five feet in width and in length, and about ſix feet in height; and here the gunpowder is ſtowed. The sauciſſe of the mine is the train, for which there is always a little aperture left.

Two ounces of powder have been found, by experiment, capable of raiſing two cubic feet of earth; conſequently 200 ounces, that is, 12 pound 8 ounces, will raiſe 200 cubic feet, which is only 16 feet ſhort of a cubic toiſe, becauſe 200 ounces joined together have proportionably a greater force than 2 ounces, as being an united force.

All the turnings a miner uſes to carry on his mines, and through which he conducts the sauciſſe, ſhould be well filled with earth and dung; and the maſonry in proportion to the earth to be blown up, as 3 to 2. The entrance of the chamber of the mine ought to be firmly ſhut with thick planks, in the form of a St Andrew's croſs, ſo that the incloſure be ſecure, and the void ſpaces ſhut up with dung or tempered earth. If a gallery be made below or on the ſide of the chamber, it muſt abſolutely be filled up with the ſtrongeſt maſonry, half as long again as the height of the earth; for this gallery will not only burſt, but likewiſe obſtruct the effect of the mine. The powder ſhould always be kept in ſacks, which are opened when the mine is charged, and ſome of the powder ſtrewed about: the greater the quantity of earth to be raiſed is, the greater is the effect of the mine, ſuppoſing it to have the due proportion of powder. Powder has the ſame effect upon maſonry as upon earth, that is, it will proportionably raiſe either with the ſame velocity.

The branches which are carried into the ſolidity of walls do not exceed three feet in depth, and two feet ſix inches in width nearly: this ſort of mine is moſt excellent to blow up the ſtrongeſt walls.

The weight of a cubic foot of powder ſhould be 80 lb. 1 foot 1 inch cube will weigh 100 lb. and 1 foot 2 inches and $\frac{1}{11}$, 150 lb. and 200 lb. of powder will be 1 foot 5 inches cube; however, there is a diverſity in this, according to the quantity of ſaltpetre in the gunpowder.

If, when the mines are made, water be found at the bottom of the chamber, planks are laid there, on which the powder is placed either in ſacks or barrels of 100 lb. each. The sauciſſe muſt have a clear paſſage to the powder, and be laid in an auget or wooden trough, through all the branches. When the powder is placed in the chamber, the planks are laid to cover it, and others again acroſs theſe; then one is placed over the top of the chamber, which is ſhaped for that purpoſe: between that and thoſe which cover the powder, props are placed, which ſhore it up; ſome inclining towards the outſide, others to the inſide of the wall; all the void ſpaces being filled with earth, dung, brick, and rough ſtones. Afterwards planks are placed at the entrance of the chamber, with one acroſs the top, whereon they buttreſs three ſtrong props, whoſe other ends are likewiſe propped againſt another plank ſituated on the ſide of the earth in the branch; which props being well fixed between the planks with wedges, the branch ſhould then be filled up to its entrance with the forementioned materials. The sauciſſes which paſs through the ſide branches muſt be exactly the ſame length with that in the middle, to which they join: the part which reaches beyond the entrance of the mine is that which conveys the fire to the other three; the sauciſſes being of equal length, will ſpring together.

From a great number of experiments, it appears, 1. That the force of a mine is always towards the weakeſt ſide; ſo that the diſpoſition of the chamber of a mine does not at all contribute to determine this effect. 2. That the quantity of powder muſt be greater or leſs, in proportion to the greater or leſs weight of the bodies to be raiſed, and to their greater or leſs cohesion; ſo that you are to allow for each cubic fathom

Of looſe earth, - -	9 or 10lb.
Firm earth and ſtrong ſand,	11 or 12
Flat clayey earth, -	15 or 16
New maſonry, not ſtrongly bound,	15 or 20
Old maſonry, well bound,	25 or 30

3. That the aperture, or entonnoir of a mine, if rightly charged, is a cone, the diameter of whoſe baſe is double the height taken from the centre of the mine. 4. That when the mine has been overcharged, its entonnoir is nearly cylindrical, the diameter of the upper

Mineral. extreme not much exceeding that of the chamber. 5. That befides the fhock of the powder againft the bodies it takes up, it likewife crufhes all the earth that borders upon it, both underneath and fidewife.

To charge a mine fo as to have the moft advantageous effect, the weight of the matter to be carried muft be known; that is, the folidity of a right cone, whofe bafe is double the height of the earth over the centre of the mine: thus, having found the folidity of the cone in cubic fathoms, multiply the number of fathoms by the number of pounds of powder neceffary for raifing the matter it contains; and if the cone contains matters of different weights, take a mean weight between them all, always having a regard to their degree of cohefion.

As to the difpofition of mines, there is but one general rule, which is, that the fide towards which one would determine the effect be the weakeft; but this varies according to occafions and circumftances.

The calculation of mines is generally built upon this hypothefis, That the entonnoir of a mine is the fruftum of an inverted cone, whofe altitude is equal to the radius of the excavation of the mine, and the diameter of the whole leffer bafe is equal to the line of leaft refiftance; and though thefe fuppofitions are not quite exact, yet the calculations of mines deduced from them have proved fuccefsful in practice; for which reafon this calculation fhould be followed till a better and more fimple be found out.

M. de Valliere found that the entonnoir of la mine was a parabaloid, which is a folid generated by the rotation of a femiparabola about its axis; but as the difference between thefe two is very infignificant in practice, that of the fruftum of a cone may be ufed.

MINERAL, in natural hiftory, is ufed in general for all foffile bodies, whether fimple or compound, dug out of a mine; from whence it takes its denomination.

Mineral Waters. All waters naturally impregnated with any heterogeneous matter which they have diffolved within the earth may be ealled *mineral waters*, in the moft general and extenfive meaning of that name; in which are therefore comprehended almoft all thofe that flow within or upon the furface of the earth, for almoft all thefe contain fome earth or felenites. But waters containing only earth or felenites are not generally called *mineral*, but *hard* or *crude waters*.

Hard waters, which are fimply felenetic, when tried by the chemical proofs, fhow no marks of an acid or of an alkali, nor of any volatile, fulphureous, or metallic matters. Waters which contain a difengaged calcareous earth, change the colour of fyrup of violets to a green; and thofe that contain felenites, being mixed with a folution of mercury in nitrous acid, form a turbith mineral; and when a fixed alkali is added, they are rendered turbid, and a white fediment is precipitated. Thefe waters alfo do not diffolve foap well. From thefe circumftances we may know, that any water which produces thefe effects is a hard, earthy, or felenetic water. The waters impregnated with gas are alfo hard.

Although the waters of the fea and faline fprings be not generally enumerated amongft mineral waters, they might neverthelefs be juftly confidered as fuch: for befides earthy and felenetic matters, they alfo contain a large quantity of mineral falts. We fhall therefore confider them as fuch in this article.

Mineral waters, properly fo called, are thofe in which gas, or fulphureous, faline, or metallic fubftances, are difcovered by chemical trials. As many of thefe waters are employed fuccefsfully in medicine, they are alfo called *medicinal waters*.

Mineral waters receive their peculiar principles by paffing through earths containing falts, or pyritous fubftances that are in a ftate of decompofition. Some of thefe waters are valuable from the quantity of ufeful falts which they contain, particularly of common falt, great quantities of which are obtained from thefe waters; and others are chiefly valued for their medicinal qualities. The former kind of mineral waters is an object of manufacture, and from them is chiefly extracted that falt only which is moft valuable in commerce. See SALT.

Many of thofe waters have been accurately analyfed by able chemifts and phyficians. But notwithftanding thefe attempts, we are far from having all the certainty and knowledge that might be defired on this important fubject; for this kind of analyfis is perhaps the moft difficult of any in chemiftry.—Almoft all mineral waters contain feveral different fubftances, which being united with water may form with each other numberlefs compounds. Frequently fome of the principles of mineral waters are in fo fmall quantity, that they can fcarcely be perceived; although they may have fome influence on the virtues of the water, and alfo on the other principles contained in the water.—The chemical operations ufed in the analyfis of mineral waters, may fometimes occafion effential changes in the fubftances that are to be difcovered. And alfo, thefe waters are capable of fuffering very confiderable changes by motion, by reft, and by expofure to air.

Probably alfo the variations of the atmofphere, fubterranean changes, fome fecret junction of a new fpring of mineral or of pure water, laftly the exhauftion of the minerals whence waters receive their peculiar principles, are caufes which may occafionally change the quality of mineral waters.

We need not therefore wonder that the refults of analyfes of the fame mineral waters made by different chemifts, whofe fkill and accuracy are not queftioned, fhould be very different.

The confequences of what we have faid on this fubject are, That the examination of mineral waters is a very difficult tafk; that it ought not to be attempted but by profound and experienced chemifts; that it requires frequent repetitions, and at different times; and laftly, that no fixed general rules can be given concerning thefe analyfes.

As this matter cannot be thoroughly explained without entering into details connected with all the parts of chemiftry, we fhall here mention only the principal refults, and the moft effential rules, that have been indicated by the attempts hitherto made on this fubject.

We may admit the divifion or arrangement of mineral waters into certain claffes, propofed by fome of the beft chemifts and naturalifts.

Some of thefe waters are called *cold*, becaufe they are not naturally hotter than the atmofphere. Some of them are even colder, efpecially in fummer.

Thofe are called *hot* mineral waters, which in all feafons are hotter than the air. Thefe are of various degrees of heat, and fome of them are almoft as hot

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as boiling water, In fome mineral waters certain volatile, fpirituous, and elaftic principles may be perceived, by a very fenfible piquant tafte: this principle is called the *gas* or *fpirit* of the waters.

The waters which contain this principle are generally lighter than pure water. They fparkle and emit bubbles, at their fpring, but efpecially when they are fhaken, and poured from one veffel into another. They fometimes break the bottles containing them, when thefe are well corked, as fermenting wines fometimes do. When mixed with ordinary wine, they give to it the piquancy and fparkling quality of Champaigne wine.

This volatile principle, and all the properties of the water dependent upon it, are loft merely by expofure to air, or by agitation. The waters containing this principle are diftinguifhed by the name of *fpirituous mineral waters*, or *acidulous waters*.

Other divifions of mineral waters may be made relatively to fome of their predominant principles. Hence fome waters are called *acidulous*, *alkaline*, *martial*, *neutral*, &c.

When a mineral water is to be examined, we may obferve the following rules:

Experiments ought to be made near the fpring, if poffible.

The fituation of the fpring, the nature of the foil, and the neighbouring rifing grounds, ought to be examined.

Its fenfible qualities, as its fmell, tafte, colour, are to be obferved.

Its fpecific gravity and heat are to be afcertained by the hydroftatical balance and the thermometer.

From the properties above-mentioned of fpirituous mineral waters, we may difcover whether it be one of this clafs. For greater certainty we may make the following trial. Let the neck of a wet bladder be tied to the neck of a bottle containing fome of this water. By fhaking the water, any gas that it may contain will be difengaged, and will fwell the bladder. If the neck of the bladder be then tied with a ftring above the bottle, and be cut below this ftring, fo as to feparate the bladder from the bottle, the quantity and nature of the contained gas may be further examined.

Laftly, we muft obferve the changes that are fpontaneoufly produced upon the water in clofe and in open veffels, and with different degrees of heat. If by thefe means any matter be cryftallized or depofited, it muft be fet apart for further examination.

Thefe preliminary experiments and obfervations will almoft certainly indicate, more or lefs fenfibly, fomething concerning the nature of the water, and will point out the method to be followed in our further inquiry.

We muft then proceed to the decompofition of the water, either without addition, and merely by evaporation and diftillation, or with the addition of other fubftances, by means of which the matters contained in the water may be precipitated and difcovered. It is not material which of thefe two methods be firft practifed, but it is quite neceffary that the one fhould fucceed the other. If we begin by evaporating and diftilling, thefe operations muft be fometimes interrupted, that the feveral principles which rife at different times of the diftillation may be obtained and examined feparately, and alfo to allow the feveral falts that may be contained to cryftallize by the evaporation and by cold.

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The fubftances which have hitherto been met with in mineral waters are,

1. *Vitriolic acid.* This acid is fometimes found pure and unmixed with any other fubftance, though more frequently joined with iron or copper. In its pure ftate, it is moft frequently found in the neighbourhood of volcanoes, where, in the opinion of Dr Donald Monro, it is moft probably "diftilled from mines of vitriol or of pyrites-ftone, decompofed by fubterraneous fire." It feems, however, more probably to proceed from the decompofition of fulphur; for neither vitriol nor pyrites will at all give a pure acid. This only can be obtained from the fumes of fulphur, which we know abound in all fuch places. Dr Vandellius, in a book intitled *De Thermis Agri Patavini*, publifhed in 1761, mentions a cave near to the town of Latera, about 30 miles from Viterbo, in Italy, where a clear acid water drops from the crevices of the rocks, and is collected by the country people in glazed earthen veffels. This has a mild agreeable tafte, and is found to be a pure vitriolic acid much diluted. The cavern, however, is fo filled with noxious vapours, that it cannot be entered without danger of fuffocation except in winter, or when it blows a north wind. A fimilar native vitriolic water is mentioned by Theophilus Griffonius, near the town of Salvena. Varenius alfo mentions a fpring in the province of Nota in Sicily, the waters of which are fo four, that the neighbouring people ufe it inftead of vinegar. In fome wafte coal pits, the water taftes four, and effervefces with alkalies; but in all thefe the acid is mixed with much vitriol, or other matter. Dr Monro mentions acid dews collected in the Eaft Indies: this acid he fuppofes to be the vitriolic, and that it probably imparts fome acidity to waters upon which the dews fall.

2. *Nitrous* and *marine* acids are never found in waters pure, though the former is frequently found combined with calcareous earth, and the latter with foffile alkali, calcareous earth, or magnefia.

3. *Fixed air* enters into the compofition of all waters; but abounds particularly in thofe of the mineral kind, at leaft fuch as are cold. It imparts an agreeable acidulous tafte to fuch water as it is mixed with, and is found by undoubted experiments to be that which gives the power and efficacy to the cold kind. It is known to be a folvent of iron, and that by its means this metal is very often fufpended in waters; and Dr Dejean of Leyden, in a letter to Dr Monro in the year 1777, fuppofes it to be the medium by which fulphur alfo is diffolved. "Having been lately at Aix La Chapelle (fays he), I mixed a folution of arfenic in the marine acid with fome of the water of the emperor's bath, and immediately a true and genuine fulphur was precipitated to the bottom of the veffel in which the water was contained; which convinced me that the fulphur was diffolved by means of fixed air, though Sir Torbern Bergman thinks otherwife, and that the fulphur is fufpended by means of phlogifton, and the matter of heat united in the waters; and he fays, that if the concentrated nitrous acid be added to thefe waters, it feizes the phlogifton, precipitates the fulphur, and takes away the hepatic fmell." If fulphur is by this medium fufpended in

water, however, it muſt be by a natural proceſs, with which we are entirely unacquainted; for we cannot unite ſulphur and fixed air artificially. We are not informed whether there is any native mineral water impregnated only with fixed air; probably, indeed, there is not, for water thus impregnated becomes a very active ſolvent of calcareous and other earths, and muſt undoubtedly meet with ſomething or other of this kind in paſſing through the ground. Many waters in Germany, particularly in the neighbourhood of the Rhine, are very much impregnated with this acid, and are eſteemed otherwiſe pretty pure; but they have never been examined chemically to diſcover whether they are not impregnated alſo with ſome proportion of metallic or earthy ſubſtances.

4. *Vegetable alkali* was long ſuppoſed to be a production entirely artificial; but ſome late authors ſeem to think that it is a native ſalt as well as the vegetable alkali. M. Margraaf mentions his having got a true nitre, the baſis of which is the vegetable alkali, from ſome waters at Berlin. M. Monnet ſays, that from the Pohoun ſpaw water he obtained eight grains of a grey-coloured alkaline ſalt from a reſiduum of twelve Paris pints of the water, which he ſaturated with the vitriolic acid; and on diluting, evaporating, and cryſtallizing, he obtained a tartarus vitriolatus, and not a Glauber's ſalt as he expected. Dr Hoffman affirms, that he obtained a vitriolated tartar from the Seltzer water by mere evaporation: but as this ſalt has neither been found in Seltzer nor any other water by other chemiſts, it is probable that he has been miſtaken.

5. The *foſſil alkali* is found in many waters in Hungary, Tripoli, Egypt, and other countries where that ſalt is found native. It is combined in Seltzer water, and other acidulous waters, with fixed air, and may be obtained from them pretty pure by ſimple evaporation. M. Monnet informs us, that he has obtained it in tolerable purity from the waters of Auvergne: but in moſt of the alkaline waters this ſalt was in an imperfect ſtate, and may be called rather an embryo than a perfect ſalt; for it would not cryſtallize, and made a very imperfect neutral ſalt with acids. It was incapable alſo of decompoſing the ſelenites, which was frequently found along with it in the ſame water.—Bergman makes mention of an imperfect alkaline ſalt; but obſerves, that all of that kind which he had an opportunity of examining, appeared to him to be no other than a genuine mineral alkali mixed with deliqueſcent ſalts.

In ſome of the mineral waters near volcanoes, this kind of alkali has been found ſo intimately united with phlogiſton as to be capable of producing a true Pruſſian blue, on adding a ſolution of ſilver or of green vitriol to the water; of which an example is given by Dr Nichola Andrea, in the thermal waters of a ſpring in the iſland of Iſchia.

6. *Volatile alkali* has formerly been accounted an ingredient in mineral waters; but Dr Hoffman, and moſt of the later chemiſts, have denied this, as the volatile alkali is not a mineral ſubſtance. It is poſſible, indeed, that ſome waters in the neighbourhood of great quantities of putrid matter may give ſome tokens of volatile alkali, as was the caſe with Rathbone-place water, analyſed by the Hon. Henry Cavendiſh.

7. *Glauber's ſalt.* Many mineral waters contain a portion of this ſalt, though the quantity is commonly very ſmall. However, M. Boulduc, in the memoirs of the academy of ſciences at Paris for 1724, makes mention of the waters of a ſpring in the neighbourhood of a village about three leagues from Madrid, which, by evaporation, yields a true Glauber's ſalt.—This ſalt, he ſays, is found in a concreted ſtate about the ſides of the ſpring, reſembling the icicles which in winter hang from the roofs of houſes. From this circumſtance, it would ſeem that the water of the ſpring was very richly impregnated with the ſalt; and Dr Nichola Andrea ſpeaks of a water at Sællia, in Calabria, which is ſo ſtrongly impregnated with this kind of ſalt, that he thinks it would be worth while to prepare it from thence in the way of trade. It is very probable that ſuch waters are frequently to be met with in countries where the ſoil is impregnated with mineral alkali.

8. *Common nitre.* In ſome of the barren provinces of Bengal, the earth is ſo ſtrongly impregnated with this ſalt, that the ſurface is covered with a nitrous cruſt reſembling hoar-froſt; and in ſuch places the waters are ſtrongly impregnated with it, as may naturally be ſuppoſed. In colder countries, however, this impregnation is more rare, though inſtances of perfect nitre being found in ſprings are not wanting in Europe; but no natural combination of nitrous acid with foſſil alkali, or cubic nitre, has yet been met with in any part of the world.

9. *Sea ſalt.* This abounds not only in the waters of the ocean, but in great numbers of ſalt ſprings; and there are but few waters ſo pure as not to contain ſome portion of it.

10. *Aerated foſſile alkali.* This is found in Seltzer, and other waters of that kind, but combined with ſuch a quantity of fixed air, that the acrid taſte of the alkali is entirely covered, and the water has a briſk acidulous one. By evaporating the water, however, this ſuperfluous quantity of air is diſſipated, and the alkali then appears in its more acrid ſtate.

11. *Gypſum*, or *ſelenites.* This compoſition of the vitriolic acid and lime is extremely common in mineral waters. For a long time it was ſuppoſed to be a ſimple earth or ſtone, on account of its difficult ſolubility in water, requiring 700 or 800 times its own weight of water to diſſolve it artificially, though Dr Rutty informs us, that the water in which it is originally diſſolved will contain four or five times that proportion. There are to appearance ſeveral kinds of this ſubſtance; but whether they ariſe from foreign mixture, or from any difference in the calcareous earths among themſelves, we know not. It is not, however, conſidered as a medicinal ingredient, nor indeed is the internal uſe of it thought to be very ſafe.

12. *Epſom ſalt.* Bergman and ſome other chemiſts have reduced all the calcareous purging ſalts in which the vitriolic acid is concerned; but Dr Monro obſerves, that theſe ſalts not only cryſtallize in various modes, but have different degrees of ſolubility in water.—Thus the Epſom ſalt, properly ſo called, diſſolves in an equal quantity of water; while the calcareous nitres, or purging ſalts from mineral waters, require from 10 to 80 times their weight to diſſolve them.—This matter would require the analyſis of a great num-

ber of falts obtained from mineral waters in large quantity, and has not yet been thoroughly explained. Thefe falts, however, are feldom met with by themfelves in mineral waters, but ufually mixed with fea-falt, iron, earth, fulphureous matter, &c. Dr Rutty tells us, that a mineral water begins to be laxative when it contains ten grains of this falt to a pint, or 80 to a gallon.

13. *Alum.* This was formerly fuppofed to be a very common ingredient in mineral waters; but more accurate obfervations have fhown it to be very rare, infomuch that Dr Hoffman thinks it is not to be met with in any. Dr Layard, however, in the 56th volume of the Philofophical Tranfactions, gives an account of a chalybeate water at Somerfham, from which he got five grains of alum out of two pounds of the water. Dr Rutty fuppofes that the mineral water at Ballycaftle, in Ireland, contains alfo a portion of this falt.

14. *Calcareous nitre.* This is rarely found in mineral waters, though common enough in fuch as are fimply called *hard* waters. Dr Monro fays, that the only one containing this ingredient which he ever heard of is one mentioned by Dr Home, in his treatife on bleaching.

15. 16. *Muriated calcareous earth, and muriated magnefia.* Muriated calcareous earth is likewife a rare ingredient in mineral waters, though frequently mentioned by writers on this fubject. Bergman informs us, that he obtained a fmall quantity from a fpring in Oftro-Gothland; and Dr Monro got fome from the water of a falt fpring at Pitkeathly, near Perth, in Scotland. It is found, as well as muriated magnefia, in fea water, though the latter is much more abundant, and probably to be met with in all falt waters whatever, but is very difficult to be obtained in a cryftalline form; though its prefence and nature may always be afcertained, by dropping vitriolic acid into the concentrated liquor fuppofed to contain it, which will both precipitate the calcareous earth, and raife the marine acid in vapours. Muriated magnefia is likewife found in falt waters, and abounds in thofe of the ocean. It is the principal ingredient in the bitter ley remaining after the falt is extracted from fea-water, and is much more capable of being cryftallized than the former.

17. *Aerated calcareous earth,* and *aerated magnefia.* Both thefe earths may be diffolved by means of fixed air, and frequently are fo in mineral waters, as well as iron. They are likewife often found in great quantity in hard waters; nor is there probably any kind of water, unlefs that which is diftilled, entirely void of them.—When fuch waters are boiled, the air evaporates, and the earth falls to the bottom, which will alfo be the cafe upon long expofure to the air. Hence originates the cruft upon tea-kettles, the petrefactions upon different fubftances immerfed in fome kinds of water, &c. Hence alfo hard waters become foft, by running in channels for a confiderable way; and to this caufe we may with probability afcribe the growth of ftones in rivulets.

18. *Vitriolated copper.* This falt is feldom found, except in waters which flow from copper mines. The water impregnated with it is emetic and purgative, and may juftly be accounted poifonous rather than medicinal. On dipping clean iron into fuch water, the copper is inftantly precipitated in its metallic ftate, and the iron diffolved in its ftead. Sometimes the quantity of copper is fo great, that it is found advantageous to extract it in this way, as is the cafe in a certain ftream in Ireland.

19. *Vitriolated iron* is found in confiderable quantity in feveral waters both of England, Scotland, and Ireland, as well as in many countries on the continent. Some authors have imagined, that there is a kind of volatile vitriol with which waters are fometimes impregnated. An anonymous author, in a work intitled *delle Terme Porretane*, publifhed at Rome in 1768, informs us, that having fixed a glafs receiver to a hole through which the vapour of the water rifes from the aqueduct below, he found in it a month afterwards, as well as in the mouth of the hole, a concrete and incruftated fubftance, like ftalactite, which by experiment proved to be a true falt of iron, with a fuperabundant quantity of acid. Hence he concludes, that this water, as it rifes from the fpring, is impregnated with a fine volatile martial vitriol, in fuch fmall proportion that it cannot be difcovered in any quantity that may be analyfed in retorts or ftills, though it may be difcovered by confining for a long time the vapour, which is naturally and conftantly fublimed from the whole body of the thermal water difcharged from the fpring, as it paffes through the aqueducts. The water of this fpring is ftrongly fulphureous, and its heat 92 degrees of Fahrenheit.

Another kind of fuppofed volatile vitriol is that compofed of iron, diffolved by fixed air. The notion of this being a volatile fubftance arofe from obferving that there are fome waters which tafte ftrongly chalybeate at the fountain, but, after running for a little way, lofes it entirely. This, however, is founded on a miftake; for it is only one of the ingredients, viz. the fixed air, which flies off when it is combined with earth; after which the iron precipitates in a fimilar manner.

20. *Vitriolated zinc.* This has been found native in the bowels of the earth; and thence has been fuppofed, not without reafon, to be an ingredient in mineral waters: but none have yet brought any decifive experiments on this fubject, except Dr Rutty and Dr Gmelin, who both fay that they have obtained a white vitriol from mineral waters which were at the fame time impregnated with iron and fome other ingredients.

21. *Muriated manganefe.* Waters impregnated with this falt are mentioned both by Bergman and Scheele; but the particular properties of them are not known.

22. *Arfenic* has been fuppofed fometimes to be an ingredient in mineral waters, though no certain proofs of its exiftence have been brought. Poifonous fprings, fuppofed to be impregnated with it, are mentioned by Varenius; and Dr Baldaffari tells us of a fmall fpring (near to the Aqua Sancta, in the country of Siena), the waters of which kill any animal that drinks them. He fufpects this to be owing to arfenic, but was afraid to analyfe the water.

23. *Foffil oils.* Almoft all waters, even thofe which are accounted the moft pure, contain fome portion of an oily matter, though generally fo fmall hat it cannot be perceived without evaporating a large quantity of the liquid. Some contain it in great quantity; infomuch that, befides impregnating the water as ftrongly as poffible, a great quantity falls to the bottom,

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tom, or ſwims on the top. The other ingredients of theſe bituminous waters have not been examined; but in whatever manner the oil is united with the water, a portion of it adheres very obſtinately, ſo that it cannot be fully ſeparated even by filtration through paper. A fine bituminous vapour riſes from the bottom of ſome wells, and pervades the water, taking fire on the application of any flaming ſubſtance, though no oil is obſerved in the water itſelf. Of this kind are the burning wells at Broſely and Wigan in Lancaſhire in England, and others in different countries.— The cauſe of the inflammation of theſe waters was firſt diſcoveeed in 1759 by Mr Thomas Shirley, who cauſed the waters of the well at Wigan to be drained away; and found that the inflammable vapour roſe from the ground at the bottom, where it would take fire, as it did at the ſurface of the water. On applying his hand to the place whence the vapour iſſued, he found the impulſe of it like a ſtrong breath; or wind; and the ſame ſenſation was felt on applying his hand to the ſurface of the water. See *Phil. Tranſ.* vol. 26.

24. *Sulphur.* This is a common ingredient in mineral waters; and its preſence is known by the ſtrong hepatic ſmell they emit, as well as by their blackening ſilver, &c. Sulphureous waters are frequently very clear and tranſparent when taken up at the fountain; but when kept in open veſſels, or bottles not well ſtopped, they ſoon depoſit the ſulphur they contain in the form of a dirty white powder, and loſe their ſulphureous ſmell. The bottom of the wells containing ſuch waters, or of the channels in which they run, aſſume a black colour, and a raggy kind of matter is depoſited on ſuch ſubſtances as they run over for ſome time; and when theſe are taken up and dried, they appear covered with a true ſulphur. Some waters contain this ingredient in very conſiderable quantity. From that of Harrowgate it may be ſeparated by filtration; and Father de Tertre, in the ſecond volume of his *Hiſtoire Naturelle des Antilles*, tells us, that when he was in the iſland of Guadaloupe, and amuſing himſelf one day with evaporating in a tin plate ſome ſulphureous water which he found near the burning mountain, there remained on the plate a layer of ſulphur about the thickneſs of a leaf of paper. Dr Monro mentions his having obtained a true ſulphur, by evaporation, from a mineral water at Caſtle-Leod, in the county of Roſs, in Scotland. Dr Brown, in his Travels, informs us, that having cauſed ſome of the pipes which carry off the water from the duke's bath at Baden, in Auſtria, to be opened, he took from thence a quantity of fine ſulphur in powder, ſomething like flour of brimſtone, which had been ſublimed from the waters. A ſimilar kind of ſulphur is obtained from the upper part of the pipes and conduits which convey the waters of Aix-la-Chapelle from their ſources.

From theſe, and other facts of a ſimilar nature, Dr Monro concludes, that ſulphur is diſſolved by ſome means or other in the water. Great differences, however, have taken place among chemiſts concerning the mode in which ſulphur is thus diſſolved. Sulphur, we know, may be diſſolved by means of an alkali, as well as by calcareous earth; and there are ſome inſtances of alkaline waters containing ſulphur, though we are not abſolutely certain that the alkaline ſalt is the bond of union betwixt the ſulphur and them. Dr Vandellius, in his treatiſe *de Thermis agri Patavini*, already quoted, mentions a ſubſtance found in the conduits of the waters of the baths at Aponum, which he calls cryſtallized ſulphur, and ſays that it diſſolves in the waters by boiling, recovering afterwards its ſolid form. This ſubſtance has not been examined; but we know of no other mineral with which ſulphur readily aſſumes a cryſtalline form than terra ponderoſa.— This compound is eaſily diſſolved in water, and communicates to it a moſt powerful taſte and ſmell of hepar ſulphuris. Great part of the terra ponderoſa, though not the whole, may be ſeparated by fixed air, ſo that it is probably this permanent compound which Vandellius obſerved. Dr Lucas ſuppoſed that the ſulphureous waters contain both an acid and phlogiſton; and Sir Torbern Bergman, that they are impregnated only with the hepatic gas; and that this gas conſiſts of ſulphur united with phlogiſton, from which the ſulphur may be precipitated by the nitrous acid.

For an account of the cauſe of heat in mineral waters, ſee the article SPRINGS.

Having now mentioned the principal ſubſtances that form almoſt all theſe waters, we ſhall next ſhow the proofs by means of which they may be diſcovered in water, without decompoſing the water by evaporation or by diſtillation.

If any portion of diſengaged acid or alkali be contained in water, it may be known by the taſte, by changing the colour of violets or of turnſol, and by adding the preciſe quantity of acid or of alkali that is neceſſary for the ſaturation of the contained diſengaged ſaline matter.

Sulphur, and liver of ſulphur, may be diſcovered in waters by their ſingular ſmell, and by the black colour which theſe ſubſtances give to white metals or to their precipitates, but eſpecially to ſilver.

Vitriolic ſalts with earthy baſis may be diſcovered in water by two proofs: 1. By adding ſome fixed alkali, which decompoſes all theſe ſalts, and precipitates their earthy baſis; and, 2. By adding a ſolution of mercury in nitrous acid, which alſo decompoſes theſe ſalts, and forms a *turbith mineral* with their acid. But for this purpoſe the ſolution of mercury ought to have a ſuperabundant quantity of acid: for this ſolution, when perfectly ſaturated, forms a precipitate with any kind of water, as M. Rouelle has very juſtly remarked: and indeed, all metallic ſolutions in any acids are ſtrictly capable of decompoſition by water alone, and ſo much more eaſily as the acid is more perfectly ſaturated with the metal.

Martial vitriol or iron combined with any acid, or even with gas, ſhows itſelf in waters by blackening an infuſion of galls, or by forming a Pruſſian blue with the phlogiſticated alkaline lixivium.

The vitriol of copper, or copper diſſolved by any acid, may be diſcovered by adding ſome of the volatile ſpirit of ſal ammoniac, which produces a fine blue colour; or by the addition of clean iron, upon the ſurface of which the copper is precipitated in its natural or metallic ſtate.

Glauber's ſalt is diſcovered by adding a ſolution of mercury in nitrous acid, and forming with it a turbith mineral; or by cryſtallization.

Common ſalt contained in waters forms with a ſolution

Mineral. lution of silver in nitrous acid a white precipitate, or luna cornea. It may also be known by its crystallization. Marine salt with earthy basis produces the same effect upon solution of silver. It also forms a precipitate when fixed alkali is added. The acrimony, bitterness, and deliquescency of this salt, serve to distinguish it.

The proofs related for the examination of mineral waters, are only those which are most essential. Many others may be made to confirm the former proofs: but the details of these are too extensive to be inserted here. We shall add only two of them, because they are very general, and may be very useful.

The first is the production of artificial sulphur, or of the volatile sulphureous acid; by which means the vitriolic acid may be discovered in any combination whatever. For this purpose, the matter to be examined must be mixed with any inflammable substance, and exposed to a red heat. If this matter contained but a particle of vitriolic acid, it would be rendered sensible by the sulphur, or by the volatile sulphureous acid thence produced.

The second general proof for mineral waters which we shall mention here, serves to discover any metallic substance whatever, dissolved in water by any acid. This proof consists in adding some of the liquor saturated by the colouring matter of Prussian blue. This liquor produces no effects upon any neutral salts with earthy or alkaline bases, but decomposes all metallic salts: so that if no precipitate be formed upon adding some of this liquor, we may be certain that the water does not contain any metallic salt; and on the contrary, if a precipitate be formed, we may certainly infer that the water does contain some metallic salt. Mineral.

Two kinds only of gas, or the spirituous volatile part of some waters, are hitherto known; of which one is the volatile sulphureous acid, and the other is fixed air. See Aerology, Fixed *Air*, and Gas, *passim*. Air united superabundantly with spirituous waters is the chief cause of their lightness, piquancy, and sparkling.

When the nature and quantities of the principles contained in a mineral water are ascertained by suitable experiments, we may imitate artificially this water, by adding to pure water the same proportions of the same substances, as Mr Venel has done in examining several waters, especially that of Selters.

We may easily perceive the necessity of using no vessels in these experiments, but such as are perfectly clean and rinsed with distilled water; of weighing the products of the experiments very exactly; of making the experiments upon as large quantities of water as is possible, especially the evaporations, crystallizations, and distillations; and of repeating all experiments several times. We may further observe, that the mixtures from which any precipitates might be expected ought to be kept two or three days, because many of these precipitates require that time, or more, to appear, or to be entirely deposited.

An Alphabetical Table of the most noted Mineral Waters in Europe, exhibiting their Medicinal Properties and Contents.

Names of Springs.	*Countries in which they are found.*	*Contents and quality of the water.*	*Medicinal Virtues.*
Abcourt,	Near St Germain's in France.	A cold chalybeate water, containing besides the iron a small quantity of fossil alkali saturated with fixed air.	Diuretic and purgative. Internally used in dropsies, jaundice, and obstructions of the viscera; externally in scorbutic eruptions, ulcers, &c.
Aberbrothick,	County of Forfar in Scotland.	A cold chalybeate. Contains iron dissolved in fixed air.	Diuretic and corroborative. Used in indigestions, nervous disorders, &c.
Acton,	Middlesex county, England.	Contains Epsom and sea salt. Cold.	Strongly purgative, and causes a soreness in the fundament.
Aghaloo,	Tyrone, Ireland.	Sulphur, fossile alkali, and some purging salt. Cold.	Alterative and corroborant. Useful in scrofulous disorders, worms, and cutaneous diseases.
Aix-la-Chapelle,	Juliers in Germany.	Sulphureous and hot. Contain aerated calcareous earth, sea-salt, fossile alkali, and sulphur.	Diaphoretic, purgative, and diuretic. Used as baths as well as taken internally. Useful in rheumatisms, and all diseases proceeding from a debility of the system.
Alford or Awford,	Somersetshire, England.	A purging salt along with sea-salt. Cold.	Strongly purgative.
Askeron,	Yorkshire, in England.	Contains Epsom salt, aerated calcareous earth, and sulphur. Cold.	Diuretic. Useful when drank in leprosy, scabs, and other cutaneous diseases.
Antrim,	Ireland,		Similar to Barrowdale water, but weaker.
Baden,	Swabia in Germany.	Hot and sulphureous springs and baths, resembling those of Aix-la-Chapelle.	See Aix-la-Chapelle, and Baden, in the order of the alphabet.

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Bagnigge,	Middlesex, near London.	Epsom salt and muriated magnesia. Cold. Another spring contains iron and fixed air.	Strongly purgative, three half pints being a dose. The chalybeate spring also proves purgative when the bowels contain any vitiated matter.
Balimore,	Worcestershire in England.	A fine cold chalybeate, containing iron rendered soluble by fixed air, along with some other salt supposed to be fossile alkali.	Corroborative, and good in obstructions of the viscera. Drank from two to three pints in a morning.
Ball, or Baudwell,	Lincolnshire in England.	A cold petrifying water; contains aerated calcareous earth or magnesia.	Corroborative and astringent. Drunk to the quantity of two pints, or two and an half.
Balaruc,	Languedoc in France.	Hot, and contain some purging salts.	Drank as purgatives, and used as hot-baths. Useful in scrofulous and cutaneous disorders.
Ballycastle,	Antrim in Ireland.	Chalybeate and sulphureous. Cold.	Resembles that of Balemore in virtue.
Ballynahinch,	Down in Ireland.	Iron, fixed air, and sulphur. Cold.	Useful in scorbutic disorders and diseases of indigestion.
Ballyspellan,	Near Kilkenny in Ireland.	Iron, fixed air, and probably fossile alkali.	Similar in virtue to that of Balemore.
Bagniers,	Biggore in France.	Earth and sulphur. Hot.	The waters used in baths, like those of Aix-la-Chapelle. Some of the springs purgative, others diuretic.
Bareges,	Biggore in France.	Sea-salt, fossile alkali, calcareous earth, selenites, sulphur, and a fine bituminous oil. Hot.	Diuretic and diaphoretic. Useful in nervous as well as cutaneous disorders, in old wounds, and some venereal complaints. Used as baths, as well as taken internally to the quantity of a quart or three pints.
Barnet, and North-hall,	Hertfordshire in England.	Epsom salt, and aerated calcareous earth.	Purgative.
Barrowdale,	Cumberland in England.	A great quantity of sea-salt, aerated calcareous earth, and some bittern. Cold.	Strongly emetic and cathartic. Sometimes useful in the jaundice and dropsy, scorbutic disorders, and chronic obstructions. Used likewise as a bath in cutaneous diseases. Taken in the dose of a pint, containing only about seven drams and an half of sea-salt; so that a great part of the virtue must reside in the aerated calcareous earth.
Bath,	Somersetshire in England.	Iron, aerated calcareous earth, selenite, Glauber's salt, and sea-salt. Hot.	Powerfully corroborative, and very useful in all kinds of weaknesses. Used as a bath, and taken internally.
Bandola,	Italy.	Iron, fixed air, fossile alkali, and a little sulphur.—Cold.	Gently laxative, diuretic, and diaphoretic.
Brentwood,	Essex in England.	Epsom salt, and aerated calcareous earth	Purgative.
Bristol,	Somersetshire in England.	Calcareous earth, sea-salt, Epsom-salt, Glauber's salt, and selenites. Hot.	Used as a bath; and drank from four to eight ounces at a time, to two quarts per day. Useful in consumptions, diabetes, fluor albus, &c.
Bromley,	Kent in England.	Iron and fixed air. Cold.	Diuretic and corroborative.
Broughton,	Yorkshire in England.	Sulphur, sea-salt, Epsom-salt, and aerated earth. Cold.	Similar to Harrogwate.
Buxton,	Derbyshire in England.	A small quantity of sea-salt, fossile alkali, Epsom-salt, and aerated calcareous earth. Hot. Here is also a fine cold chalybeate spring.	Useful in gout, rheumatism, and other disorders in which tepid baths are serviceable. Used as baths, and drank to the quantity of five or six pints per day.

Caroline

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Caroline baths,	Bohemia.	Iron, fixed air, aerated earth, fea-falt, foffile-alkali, Epfom-falt, and Glauber's falt. Hot.	Purgative, and ufed as baths. Of fervice in diforders of the ftomach and bowels, fcrofula, &c.
Carlton,	Nottinghamfhire in England.	Iron diffolved in fixed air, along with a bituminous oil, which gives it the fmell of horfe-dung.—Cold.	Diuretic and corroborative.
Carrickfergus,	Antrim in Ireland.	Seems from its bluifh colour to contain a very fmall quantity of copper. Cold.	Weakly purgative.
Carrickmore,	Cavan in Ireland.	Foffile alkali, fixed air, and fome purging falt. Cold.	Purgative and diuretic.
Cafhmore,	Waterford in Ireland.	Green vitriol.	Purgative, diuretic, and fometimes emetic.
Caftle-Connel,	Limerick in Ireland.	Iron diffolved in fixed air, &c. Cold.	Refembles the German Spaw, and is in confiderable repute.
Caftle-Leod,	Rofs-fhire in Scotland.	Aerated earth, felenites, Glauber's falt, and fulphur. Cold.	Diuretic, diaphoretic, and corroborant; ufeful in cutaneous difeafes.
Caftlemain,	Kerry in Ireland.	Iron, fulphur, and fixed air. Cold.	Corroborant and diuretic.
Cawley,	Derbyfhire in England.	Epfom falt, aerated calcareous earth, and fulphur. Cold.	Gently purgative.
Cawthorp,	Lincolnfhire in England.	Iron, fixed air, and probably foffile alkali. Cold.	Purgative, and corrects acidities.
Chadlington,	Oxfordfhire in England.	Foffile alkali, fea-falt, and fulphur. Cold.	Purgative.
Chaude Fontaine,	Liege in Germany.	Aerated earth, foffile alkali, and fixed air. Hot.	Refembles thofe of Aix la Chapelle and Buxton.
Cheltenham,	Gloucefterfhire in England.	Calcareous earth, iron, Epfom falt, and common falt. Cold.	Purgative and corroborant; taken in the quantity of from one to three or four pints. Is ufeful in cafes of indigeftion and fcorbutic diforders; alfo in the gravel.
Chippenham,	Wiltfhire in England.	Iron diffolved in fixed air.	Diuretic and corroborative.
Cleves,	Germany.	Iron, fixed air, and other ingredients of Pyrmont water.	Diuretic and corroborant.
Clifton,	Oxfordfhire in England.	Foffile alkali, and aerated calcareous earth or felenite. Cold.	Gently laxative, and ufed as a bath for cutaneous diforders.
Cobham,	Surry in England.	Iron, and fome purging falt.	Purgative, diuretic, and corroborant.
Codfalwood,	Staffordfhire in England.	Sulphur, fixed air, and aerated earth.	Refembles the Afkeron water.
Colchefter,	Effex in England.	Epfom falt, and aerated calcareous earth.	Strongly purgative.
Colurian,	Cornwall in England.	Iron, fixed air, and aerated earth.	Corroborative and diuretic.
Comner, or Cumner,	Berkfhire in England.	Some purging falt, and probably aerated earth; the water is of a whitifh colour.	Purgative, in the quantity of one, two, or three quarts.
Coolauran,	Fermanagh in Ireland.	Iron, fixed air, and aerated earth.	Diuretic.
Corftorphin,	Mid-Lothian in Scotland.	Sulphur, fea-falt, clay, and Epfom falt. Cold.	Diuretic and laxative.
Coventry,	Warwickfhire in England.	Iron, fixed air, and fome purging falt.	Purgative, diuretic, and corroborant.

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Crickle-Spaw,	Lancashire in England.	Sulphur, sea-salt, and aerated earth.	Purgative, and resembling Harrowgate water.
Croft,	Yorkshire in England.	Aerated earth, vitriolated magnesia, and sea-salt.	Purgative, and resembling Askeron water.
Cross-town,	Waterford in Ireland.	Martial vitriol.	Diuretic, purgative, and sometimes emetic.
Cunley-house,	Lancashire in England.	Sulphur, aerated earth, and fixed air.	Purgative, and resembling the Askeron water.
Das-Wild Bad,	Nuremberg in Germany.	Iron, fixed air, and some saline matter.	Corroborant. Useful in obstructions of the viscera, and female complaints.
D'Ax en Foix,	15 leagues from Thoulouse in France.	Similar to Aix-la-Chapelle. Hot.	Used as a bath, and also drank, like the Aix-la-Chapelle waters.
Deddington,	Oxford in England.	Iron, sulphur, aerated earth, sea-salt, or fossile alkali.	Alterative, purgative in large quantity, and useful in scorbutic and cutaneous disorders.
Derby,	Near the capital of Derbyshire in England.	Iron dissolved by fixed air.	Corroborant.
Derryinch,	Fermanagh in Ireland.	Sulphur and fossile alkali.	Diuretic and diaphoretic.
Derrindaff,	Cavan in Ireland.	Sulphur and purging salt.	Similar to the *Askeron* water.
Derrylester,	Cavan in Ireland.	Similar to *Swadlingbar* water.	
Dog and Duck,	St George's-fields, London.	Aerated magnesia, Epsom salt, and sea-salt.	Cooling and purgative, but apt to bring on or increase the fluor albus in women.
Dortshill,	Staffordshire in England.	Iron dissolved in fixed air.	Corroborant.
Drig-well,	Cumberland in England.	Similar to Deddington.	
Dropping-well,	Yorkshire in England.	Aerated earth.	Astringent and corroborant.
Drumas-nave,	Leitrim in Ireland.	Sulphur, fossile alkali, with some purging salt.	Powerfully diuretic and anthelmintic, and of use in cutaneous and scrofulous disorders.
Drumgoon,	Fermanagh in Ireland.	Similar to the former.	
Dublin salt springs,	Ireland.	Sea-salt and Epsom salt.	Purgative.
Dulwich,	Kent in England.	Sea-salt and Epsom salt.	Purgative and diuretic. Useful in nervous cases and diseases proceeding from debility.
Dunnard,	18 miles from Dublin.	Iron dissolved in fixed air.	Diuretic and corroborant.
Dunse,	Scotland.	Iron dissolved in fixed air, with a little sea-salt and bittern.	Similar to the former.
Durham,	England.	Sulphur, sea-salt, and a little aerated earth. In the middle of the river is a salt spring.	Similar to the Harrowgate water.—That of the salt spring used as a purgative.
Egra,	Bohemia.	Similar to Cheltenham water.	
Epsom,	Surry in England.	Vitriolated and muriated magnesia, with a small quantity of aerated calcareous earth.	Purgative, and of use in washing old sores.
Fairburn,	Ross-shire in Scotland.	Sulphur, aerated earth, and Glauber's salt.	Alterative, and useful in cutaneous diseases.
Felstead,	Essex in England.	Similar to Islington.	
Filah,	Yorkshire in England.	Sea-salt and aerated earth.	Powerfully diuretic and purgative.
Frankfort,	Germany.	Sulphur and sea-salt.	Similar to Harrowgate.

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Gainsborough,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Gainſborough,	Lincolnſhire in England.	Sulphur, iron, aerated earth, and Epſom ſalt.	Diuretic and laxative.
Galway,	Ireland.	Similar to Tunbridge water.	
Glanmile,	Ireland.	Similar to Peterhead water.	
Glaſtonbury,	Somerſetſhire in England.	Similar to Clifton water.	
Glendy,	Merns county in Scotland.	Similar to Peterhead water.	
Granſhaw,	Down in Ireland.	Iron; ſimilar to the German Spaw.	
Haigh,	Lancaſhire in England.	Green vitriol, iron diſſolved by fixed air, with ſome aerated earth.	Emetic and cathartic.
Hampſtead,	England.	Green vitriol, iron diſſolved by fixed air, and a ſmall quantity of aerated earth.	Alterative and corroborant. The water is taken from half a pint to ſeveral pints; is better in the morning than in the middle of the day, and in cold than hot weather.
Hanbridge,	Lancaſhire in England.	Similar to Scarborough water.	Leſs purgative than the Scarborough water.
Hanlys,	Shropſhire in England.	Epſom, or other purging ſalt.	Purgative.
Harrowgate,	Yorkſhire in England.	Sulphur, ſea ſalt, and ſome purging ſalt. Some chalybeate ſprings here alſo.	Alterative, purgative, and anthelmintic; uſeful in ſcurvy, ſcrofula, and cutaneous diſeaſes. Uſed externally for ſtrains and paralytic weakneſſes.
Hartfell,	Annandale in Scotland.	Green vitriol.	Aſtringent and corroborant. Uſeful in all kinds of inward diſcharges of blood.
Hartlepool,	Durham in England.	Sulphur, iron diſſolved by fixed air, with ſome purging ſalt.	Diuretic and laxative.
Holt,	Wiltſhire in England.	Purging ſalt, with a large quantity of aerated earth.	Mildly purgative. Uſeful in old ulcers and cutaneous diſorders.
Joſeph's well,	Stock Common near Cobham in Surry.	A very large proportion of Epſom ſalt, and poſſibly a little ſea-ſalt.	Alterative, purgative, and diuretic. Drank to about a quart, it paſſes briſkly without griping: taken in leſs doſes as an alterative, it is a good antiſcorbutic.
Ilmington,	Warwickſhire in England.	Aerated foſſile alkali, with ſome iron diſſolved by fixed air.	Diuretic and laxative.
Inglewhite,	Lancaſhire in England.	Sulphur, and iron diſſolved by fixed air.	Alterative. Uſeful in ſcorbutic and cutaneous diſeaſes.
Iſlington,	Near London.	Iron diſſolved by fixed air.	Corroborant. Uſeful in lowneſs of ſpirits and nervous diſeaſes. Operates by urine, and may be drank in large quantity.
Kanturk,	Cork in Ireland.	Similar to the water at Peterhead.	
Kedleſtone,	Derbyſhire in England.	Sulphur, ſea-ſalt, and aerated earth.	Similar to Harrowgate; but intolerably fetid.
Kenſington,	Near London.	Similar to Acton water.	
Kilbrew,	Meath in Ireland.	A large quantity of green vitriol.	Emetic and cathartic, in the doſe of half a pint.
Kilburn,	Near London.	Fixed air, hepatic air, Epſom ſalt, Glauber's ſalt; muriated magneſia, ſea-ſalt, aerated earth, and iron.	
Killaſher,	Fermanagh in Ireland.	Sulphur and foſſile alkali.	Similar to Swadlinghar water.
Killingſhanvally,	Fermanagh, Ireland.	Similar to Hanly's chalybeate water.	

Kilrooty,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medicinal Virtues.*
Kilroot,	Antrim in Ireland.	Nature of Barrowdale water, but weaker.	
Kinalton,	Nottinghamſhire in England.	A purging ſalt.	Purgative.
Kincardine,	Merns in Scotland.	Similar to the water of Peterhead.	
Kingſcliff,	Northamptonſhire in England.	Similar to Cheltenham waters.	
Kirby,	Weſtmoreland in England.	Iron, fixed air, and probably ſome foſſile alkali.	Laxative, and uſeful in correcting acidities.
Knareſborough	See *Dropping-well.*		
Knowſley,	Lancaſhire in England.	Similar to Scarborough wa-	
Kuka,	Bohemia.	Aerated fixed alkali.	Operates by inſenſible perſpiration, ſometimes by ſpitting, ſweat, or urine.
Lancaſter,	England,	Similar to Tunbridge water.	
Latham,	Lancaſhire in England.	Similar to the former.	
Llandrindod,	Radnor in South Wales.	Three ſprings; a purgative, a ſulphureous, and chalybeate.	Uſeful in the ſcurvy, leproſy, cutaneous diſorders, &c.
Llangybi,	Caernarvonſhire in North Wales.		Uſeful in diſorders of the eyes, ſcrofula, &c.
Leamington,	Warwickſhire in England.	Sea-ſalt and aerated calcareous earth.	Emetic and cathartic. Uſeful in old ſores, and cures mangy dogs.
Leez,	Eſſex in England.	Similar to Iſlington water.	
Lincomb,	Somerſetſhire in England.	Aerated iron, foſſile alkali, and a little Epſom ſalt.	
Liſbeak,	Fermanagh in Ireland.	Sulphur, &c.	Similar to Swadlinghar water.
Lis-done-Vurna,	Clare in Ireland.	Foſſile alkali, with much iron.	Emetic, cathartic, and diuretic.
Loanſbury,	Yorkſhire in England.	Sulphur, and ſome purging ſalt.	Uſed only for waſhing mangy dogs and ſcabby horſes.
Maccroomp,	Cork in Ireland.	Similar to Ilmington water.	
Mahereberg,	Kerry in Ireland.	Similar to Barrowdale water.	
Mallow,	Cork in Ireland.	A hot water, ſimilar to that of Briſtol.	
Malton,	Yorkſhire in England.	Iron and fixed air in conſiderable quantity.	Similar to Scarborough water, but is ſometimes apt to vomit.
Malvern,	Gloucesterſhire in England.	Iron. Two ſprings.	Diuretic and cathartic; uſed alſo externally. Recommended as excellent in diſeaſes of the ſkin; in leproſies, ſcorbutic complaints, ſcrofula, old ſores, &c. Alſo ſerviceable in inflammations and other diſeaſes of the eyes; in the gout and ſtone, in bilious and paralytic caſes, and in female obſtructions. The external uſe is by waſhing the part at the ſpout ſeveral times a-day, and afterwards covering it with cloths dipt in the water and kept conſtantly moiſt; alſo by general bathing.
Markſhall,	Eſſex in England.	Similar to Iſlington.	
Matlock,	Derbyſhire in England.	Warm ſprings, of the nature of the Briſtol water, except that they are very ſlightly impregnated with iron, but contain a great quantity of aerated earth. They are colder than the Buxton; but their virtues ſimilar to thoſe of the two places mentioned.	

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medicinal Virtues.
Maudſley,	Lancaſhire in England.	Sulphur and ſea-ſalt.	Similar to Harrowgate.
Mechan,	Fermanagh in Ireland.	Sulphur and foſſile alkali.	Similar to the waters of Drumgoon.
Miller's Spaw,	Lancaſhire in England.	Similar to Tunbridge.	
Moffat,	Annandale in Scotland.	Sulphur, ſea-ſalt, and earth.	Alterant, diuretic, and ſometimes purgative. Is uſed as a bath, and the ſteam of the hot water has been found ſervicable in relaxing hard tumors and ſtiff joints.
Moſs-houſe,	Lancaſhire in England.	Similar to Iſlington water.	Purges ſtrongly.
Moreton,	Shropſhire in England.	Similar to Holt water.	
Mount D'Or,	France.	Warm, and ſimilar to the waters of Aix-la-Chapelle.	Diuretic, purgative, and diaphoretic.
Nevil-Holt,	Leiceſterſhire in England.	Selenite or aerated earth, and Epſom ſalt.	Purgative, diuretic, and diaphoretic.—Powerfully antiſeptic in putrid diſeaſes, and excellent in diarrhœa, dyſenteries, &c.
New Cartmall,	Lancaſhire in England.	Sea-ſalt and aerated earth.	Purgative.
Newnham Regis,	Warwickſhire in England.	Similar to Scarborough water.	
Newtondale,	Yorkſhire in England.	Aerated calcareous earth or magneſia.	Aſtringent or tonic.
Newton-Stewart,	Tyrone in Ireland.	Similar to Tunbridge.	
Nezdenice,	Germany.	Fixed air, foſſile alkali, iron, and earth.	Diuretic, diaphoretic, and tonic.
Nobber,	Meath in Ireland.	Martial vitriol.	Similar to Hartfell.
Normanby,	Yorkſhire in England.	Sulphur, much fixed air, ſome ſea-ſalt, and Epſom ſalt.	Similar to Aſkeron water.
Nottington,	Dorſetſhire, England.	Sulphur, foſſile alkali, and earth.	Uſeful in cutaneous diſeaſes.
Orſton,	Nottingham, England,	Much fixed air, Epſom ſalt, and a little ſea-ſalt, with ſome iron.	Purgative.—It intoxicates by reaſon of the great quantity of air contained in it.
Oulton,	Norfolk, England.	Similar to Iſlington.	
Owen Breun,	Cavan, Ireland.	Sulphur, Epſom ſalt, and foſſile alkali.	Similar to Aſkeron water.
Pancras,	Near London.	Epſom ſalt, and aerated earth.	Diuretic and purgative.
Paſſy,	Near Paris.	Similar to Pyrmont water.	
Peterhead,	Aberdeen county, Scotland.	A ſtrong chalybeate but of which no analyſis has been publiſhed.	Similar to Iſlington, but more powerful.
Pettigoe,	Donnegal, Ireland.	Sulphur and purging ſalt.	Similar to Aſkeron water.
Pitkeathly,	Perthſhire, Scotland.	Sea-ſalt, a ſmall quantity of muriated and likewiſe of aerated earth.	Gently purgative. Very uſeful in ſcrofulous and ſcorbutic habits.
Plombiers,	Lorraine, France.	Saline matter, probably foſſil alkali, with a ſmall portion of oil.—Warm.	Uſed as a bath, and for waſhing ulcers. Inwardly taken it cures complaints from acidity, hemorrhagies, &c.
Pontgibault,	Auvergne, France.	Foſſile alkali and calcareous earth.	Diuretic and laxative
Pougues,	Nivernois, France.	Calcareous earth, magneſia, foſſile alkali, ſea-ſalt, earth of alum, and ſiliceous earth.	Diuretic and laxative.

Pyrmont,

Names of Springs.	*Countries in which they are found.*	*Contents and Quality of the Water.*	*Medical Virtues.*
Pyrmont,	Weftphalia, Germany.	Aerated iron, calcareous earth, magnefia, Epfom falt, and common falt.	Diuretic, diaphoretic, and laxative. Recommended in cafes where the conftitution is relaxed ; in female complaints, in cutaneous difeafes, in nervous diforders, in the gravel and urinary obftructions ; and confidered as among the beft reftoratives in decayed and broken conftitutions.
Queen Camel,	Somerfetfhire, England.	Sulphur, fea-falt, foffile alkali, calcareous earth, and bituminous oil.	Ufed in fcrofulous and cutateous diforders.
Richmond,	Surry in England.	Similar to Acton water.	
Rippon,	Yorkfhire, England,	Sulphur, fea-falt, and aerated earth.	Diaphoretic and alterant.
Road,	Wiltfhire, England.	Sulphur, iron, foffile alkali, and fixed air.	Ufeful in fcrofula, fcurvy, and cutaneous diforders.—Acts as a laxative.
St Bartholomew's well,	Cork in Ireland.	Foffile alkali, iron, and fixed air.	Similar to Tilbury water.
St Bernard's well,	Near Edinburgh.	Sulphureous volatile acid and phlogifton.	Somewhat congenial with Moffat and Harrowgate. In nervous and ftomachic cafes, analeptic and reftorative ; in fcorbutic, fcrofulous, and moft dropfical cafes, reckoned a fpecific.
St Erafmus's well,	Staffordfhire, England.		Similar to Barrowdale water.
Scarborough,	Yorkfhire, England.	Aerated calcareous earth, Epfom falt, fea-falt, and iron.	Diuretic and purgative.
Scollienfis,	Switzerland.	Iron, foffile alkali, and a great quantity of fixed air.	Excellent in colic pains, both as a cure and preventative.
Sedlitz,	Bohemia.	Epfom falt.	Strongly purgative.
Seltzer,	Germany.	Calcareous earth, magnefia, foffile alkali, and fixed air.	Diuretic. Ufeful in the gravel, rheumatifm, fcurvy, fcrophula, &c.
Sene, or Send,	Wiltfhire, England.	Similar to Iflington.	
Seydfchutz,	Germany.	Similar to Seidlitz.	
Shadwell,	Near London.	Green vitriol.	Emetic and cathartic.
Shapmoor,	Weftmoreland, England.	Sulphur and purging falt.	Similar to Afkeron water.
Shettlewood,	Derbyfhire, England.		Similar to Harrowgate water.
Shipton,	Yorkfhire, England.	Sulphur, fea-falt, and purging falt.	Similar to Harrowgate.
Somerfham,	Huntingdonfhire, England.	Green vitriol, alum, and fixed air.	Corroborant and alterative. Ufeful for wafhing foul ulcers and cancers.
Spaw,	Liege in Germany.	Foffile alkali, iron, aerated earth, Epfom falt, and fea-falt.	Diuretic and purgative. Serviceable in many diforders. See the article SPAW.
Stanger,	Cumberland, England.	Green vitriol.	Emetic and cathartic.
Stenfield,	Lincolnfhire, England.	Similar to Orfton.	
Streatham,	Surry, England.	Aerated earth, Epfom falt, fea-falt, and muriated magnefia.	Purgative.
Suchaloza,	Hungary.		Similar to Nezdenice.
Sutton bog,	Oxfordfhire, England.	Sulphur, foffile alkali, and fea-falt.	Alterative and laxative.
Swadlingbar,	Cavan in Ireland	Sulphur, earth, fea-falt, and foffile alkali.	Alterative and diaphoretic.
Swanfey,	Glamorganfhire in North Wales.	Green vitriol.	Similar to Shadwell.
Sydenham,	Kent in England,	Similar to Epfom, but weaker.	

Tarleton,

Names of Springs.	Countries in which they are found.	Contents and Quality of the Water.	Medical Virtues.
Tarleton,	Lancafhire in England.	Similar to Scarborough water.	
Tewkfbury,	Gloucefterfhire in England.	Similar to Acton.	
Thetford,	Norfolk in England.	Foffile alkali, fixed air, and iron.	Purgative and diuretic.
Thoroton,	Nottinghamfhire in England.	Similar to Orfton.	
Thurfk,	Yorkfhire in England.	Similar to Scarborough.	
Tibfhelf,	Derbyfhire in England.	Iron diffolved in fixed air.	Similar to Spaw water.
Tilbury,	Effex in England.	Foffile alkali.	Diuretic and diaphoretic.
Tober Bony,	Near Dublin in Ireland.	Foffile alkali, earth, and bituminous oil.	Similar to Tilbury.
Tonftein,	Cologne in Germany.	Foffile alkali.	Similar to Seltzer, but more purgative.
Tralee,	Kerry in Ireland.	Similar to Caftle Connel.	
Tunbridge,	Kent in England.	Iron, fome fea-falt, with a little felenites and calcareous earth.	An excellent chalybeate, ufeful in all difeafes for which the Spaw is recommended.
Upminfter,	Effex in England.	Sulphur, foffile alkali, and purging falt.	Purgative and diuretic.
Vahls,	Dauphiny in France.	Foffil alkali.	Diuretic and laxative.
Wardrew,	Northumberland.	Sulphur, earth, and fea-falt.	Similar to Harrowgate water.
Weatherftack,	Weftmoreland in England.	Iron, fea-falt, and a fmall quantity of hepatic gas.	Purgative.
Wallenfrow,	Northamptonfhire in England.	Similar to Iflington water.	
Weft Afhton,	Wiltfhire in England.	Similar to Iflington.	
Weftwood,	Derbyfhire in England.	Green vitriol.	Similar to Shadwell. Ufed for wafhing ulcers of the legs.
Wexford,	Ireland.	Similar to Iflington.	
Whiteacre,	Lancafhire in England.	Aerated iron and probably calcareous earth.	Somewhat aftringent.
Wigglefworth,	Yorkfhire in England.	Sulphur, earth, and common falt.	Emetic in the quantity of two quarts, and faid to be cathartic in the quantity of three; a fingular circumftance if true.
Wildungan,	Waldech in Germany.	Similar to the waters of Bath.	Ufeful in fcorbutic and gouty difeafes.
Witham,	Effex in England.	Aerated iron, and common falt.	Diuretic, alterative, and corroborant.
Wirkfworth,	Derbyfhire in England.	Sulphur, purging falt, and aerated iron.	Ufeful in fcrofulous and cutaneous difeafes.
Zahorovice,	Germany.	Similar to Nezdenice water.	Much efteemed in fcrofulous cafes.

MINEHEAD, a town of Somerfetfhire, 166 miles from London. It is an ancient borough, with a harbour in the Briftol channel, near Dunfter caftle, much frequented by paffengers to and from Ireland. It was incorporated by Queen Elifabeth, with great privileges, on condition the corporation fhould keep the quay in repair; but its trade falling off, the quay was neglected, and they loft their privileges. A ftatute was obtained in the reign of King William, for recovering the port, and keeping it in repair, by which they were to have the profits of the quay and pier for 36 years, which have been computed at about 200 l. a year; and they were at the expence of new-build ing the quay. In purfuance of another act, confirming the former, a new head has been built to the quay, the beach cleared, &c. fo that the biggeft fhip may enter, and ride fafe in the harbour. The town contains about 500 houfes, and 2000 fouls. It was formerly governed by a portreve, and now by two conftables chofen yearly at a court-leet held by the lord of the manor. Its chief trade is with Ireland, from whence about 40 veffels ufed to come hither in a year with wool; and about 4000 chaldrons of coals are yearly imported at this place. Watchet and Poriock, from South Wales, which lies directly oppofite to it, about feven leagues over, the common breadth of this channel all the way from Holmes to the Land's End. Here are feveral rich merchants, who have fome trade alfo to Virginia and the Weft Indies; and they correfpond much with the merchants of Barneftaple and Briftol in their foreign commerce. Three or four thoufand barrels of herrings, which come up the Severn in great fhoals about Michaelmas, are caught, cured, and fhipped off here every year, for the Mediterranean, &c. The market here is on Wednefday, and fair on Whitfun-Wednefday.

MINERALOGY,

MINERALOGY,

IS that ſcience which teaches us the properties of mineral bodies, and by which we learn how to characteriſe, diſtinguiſh, and claſs them into a proper order.

INTRODUCTION.

MINERALOGY ſeems to have been in a manner coeval with the world. Precious ſtones of various kinds appear to have been well known among the Jews and Egyptians in the time of Moſes; and even the moſt rude and barbarous nations appear to have had ſome knowledge of the ores of different metals. As the ſcience is nearly allied to chemiſtry, it is probable that the improvements both in chemiſtry and mineralogy have nearly kept pace with each other; and indeed it is but of late, ſince the principles of chemiſtry were well underſtood, that mineralogy has been advanced to any degree of perfection. The beſt way of ſtudying mineralogy, therefore, is by applying chemiſtry to it; and not contenting ourſelves merely with inſpecting the outſides of bodies, but decompounding them according to the rules of chemiſtry. This method has been brought to the greateſt perfection by Mr Pott of Berlin, and after him by Mr Cronſtedt of Sweden. To obtain this end, chemical experiments in the large way are without doubt neceſſary: but as a great deal of the mineral kingdom has already been examined in this manner, we do not need to repeat all thoſe experiments in their whole extent, unleſs ſome new and particular phenomena ſhould diſcover themſelves in thoſe things we are examining; elſe the tedious neſſes of thoſe proceſſes might diſcourage ſome from going farther, and take up much of the time of others that might be better employed. An eaſier way may therefore be adopted, which even for the moſt part is ſufficient, and which, though made in miniature, is as ſcientifical as the common manner of proceeding in the laboratories, ſince it imitates that, and is founded upon the ſame principles. This conſiſts in making the experiments upon a piece of charcoal with the concentrated flame of a candle directed through a blow-pipe. The heat occaſioned by this is very intenſe; and the mineral bodies may here be burnt, calcined, melted, and ſcorified, &c. as well as in any great works.

For a deſcription of the blow-pipe, the method of uſing it, the proper fluxes to be employed, and the different ſubjects of examination to which that inſtrument is adapted, ſee the article *Blow-Pipe*, where all thoſe particulars are conciſely detailed. It may not be improper here, however, to reſume thoſe details at greater length; avoiding, at the ſame time, all unneceſſary repetitions. After which we ſhall exhibit a ſcientific arrangement of the mineral kingdom, according to the moſt approved ſyſtem.

PART. I. EXPERIMENTAL MINERALOGY; with a DESCRIPTION of the NECESSARY APPARATUS(A).

SECT. I. *Of Experiments upon Earths and Stones.*

WHEN any of theſe ſubſtances are to be tried, we muſt not begin immediately with the blow-pipe; but ſome preliminary experiments ought to go before, by which thoſe in the fire may afterwards be directed. For inſtance, a ſtone is not always homogeneous, or of the ſame kind throughout, although it may appear to the eye to be ſo. A magnifying glaſs is therefore neceſſary to diſcover the heterogeneous particles, if there be any; and theſe ought to be ſeparated, and every part tried by itſelf, that the effects of two different things, examined together, may not be attributed to one alone. This might happen with ſome of the finer micæ, which are now and then found mixed with ſmall particles of quartz, ſcarcely to be perceived by the eye. The trapp (in German *ſchwartzſtein*) is alſo ſometimes mixed with very fine particles of feltſpar (*ſpatum ſcintillans*) or of calcareous ſpar, &c. After this experiment, the hardneſs of the ſtone in queſtion muſt be tried with ſteel. The flint and garnets are commonly known to ſtrike fire with ſteel; but there are alſo other ſtones, which, though very ſeldom, are found ſo hard as likewiſe to ſtrike fire. There is a kind of trapp of that hardneſs, in which no particles of feltſpar are to be ſeen. Coloured glaſſes reſemble true gems; but as they are very ſoft in proportion to theſe, they are eaſily diſcovered by means of the file. The common quartz-cryſtals are harder than coloured glaſſes, but ſofter than the gems. The loadſtone diſcovers the preſence of iron, when it is not mixed in too ſmall a quantity in the ſtone, and often before the ſtone is roaſted. Some kinds of hæmatites, and particularly the cœruleſcens, greatly reſemble ſome other iron ores; but this diſtinguiſhes itſelf from them by a red colour when pounded, the others giving a blackiſh powder, and ſo forth.

The management of the *Blow-pipe* has been deſcribed under that article; but a few particulars may be here recapitulated, or added.

The candle ought to be ſnuffed often, but ſo that the top of the wick may retain ſome fat in it, becauſe the flame is not hot enough when the wick is almoſt burnt to aſhes; but only the top muſt be ſnuffed off, becauſe a low wick gives too ſmall a flame. The blue flame is the hotteſt; this ought, therefore, to be forced

(A) From Engeſtrom's *Treatiſe on the Blow-Pipe*, and Magellan's *Deſcription of Pocket-Laboratories*, &c. ſubjoined to the Engliſh Tranſlation of *Cronſtedt's Mineralogy*, 2d edit. in 2 vols. Dilly.

forced out when a great heat is required, and only the point of the flame muſt be directed upon the ſubject which is to be eſſayed. M. Magellan recommends, as being moſt cleanly and convenient, that the candle be made of wax, and the wick ſhould be thicker than ordinary. Its upper end muſt be bended towards the matter intended to be heated, and the ſtream of air muſt be directed along the ſurface of the bended part, ſo as not abſolutely to touch it.

The piece of charcoal made uſe of in theſe experiments muſt not be of a diſpoſition to crack. If this ſhould happen, it muſt gradually be heated until it does not crack any more, before any aſſay is made upon it. If this be not attended to, but the aſſay made immediately with a ſtrong flame, ſmall pieces of it will ſplit off in the face and eyes of the aſſayer, and often throw along with them the matter that was to be aſſayed. Charcoal which is too much burnt conſumes too quick during the experiment, leaving ſmall holes in it, wherein the matter to be tried may be loſt; and charcoal that is burnt too little, catches flame from the candle, burning by itſelf like a piece of wood, which likewiſe hinders the proceſs.

Of thoſe things that are to be aſſayed, only a ſmall piece muſt be broken off for that purpoſe, not bigger than that the flame of the candle may be able to act upon it at once, if required; which is ſometimes neceſſary, as, when the matter requires to be made red hot throughout, the piece ought to be broken as thin as poſſible, at leaſt the edges; the advantage of which is obvious, the fire having then more influence upon the ſubject, and the experiment being more quickly made.

Some of the mineral bodies are very difficult to be kept ſteady upon the charcoal during the experiment, before they are made red hot; becauſe, as ſoon as the flame begins to act upon them, they ſplit aſunder with violence, and are diſperſed. Such often are thoſe which are of a ſoft conſiſtence or a particular figure, and which preſerve the ſame figure in however minute particles they are broken; for inſtance, the calcareous ſpar, the ſparry gypſum, ſparry fluor, white ſparry lead-ore, the potters ore, the teſſellated mock-lead or blende, &c. even all the common fluors which have no determinate figure. Theſe not being ſo compact as common hard ſtones, when the flame is immediately urged upon them, the heat forces itſelf through and into their clefts or pores, and cauſes this violent expanſion and diſperſion. Many of the clays are likewiſe apt to crack in the fire, which may be for the moſt part aſcribed to the humidity, of which they always retain a portion.

The only way of preventing this inconvenience is to heat the body as ſlowly as poſſible. It is beſt, firſt of all, to heat that place of the charcoal where the piece is intended to be put on; and afterwards lay it thereon: a little crackling will then enſue, but commonly of no great conſequence. After that, the flame is to be blown very ſlowly towards it, in the beginning not directly upon, but ſomewhat above it, and ſo approaching nearer and nearer with the flame until it become red hot. This will do for the moſt part; but there are nevertheleſs ſome, which, notwithſtanding all theſe precautions, it is almoſt impoſſible to keep on the charcoal. Thus the fluors are generally the moſt difficult; and as one of their principal characters is diſcovered by their effects in the fire *per ſe*, they ought neceſſarily to be tried that way. To this purpoſe, it is beſt to make a little hole in the charcoal to put the fluor in, and then to put another piece of charcoal as a covering upon this, leaving only a ſmall opening for the flame to enter. As this ſtone will nevertheleſs ſplit and fly about, a larger piece thereof than is before-mentioned muſt be taken, in order to have at leaſt ſomething of it left.

But if the experiment is to be made upon a ſtone whoſe effects one does not want to ſee in the fire *per ſe*, but rather with fluxes, then a piece of it ought to be forced down into melted borax, when always ſome part of it will remain in the borax, notwithſtanding the greateſt part may ſometimes fly away by cracking.

1. *Of ſubſtances to be tried in the fire* per ſe. As the ſtones undergo great alterations when expoſed to the fire by themſelves, whereby ſome of their characteriſticks, and often the moſt principal, are diſcovered, they ought firſt to be tried that way, obſerving what has been ſaid before concerning the quantity of matter, direction of the fire, &c. The following are generally the reſults of this experiment.

Calcareous earth or *ſtone*, when it is pure, does not melt by itſelf, but becomes white and friable, ſo as to break freely between the fingers; and, if ſuffered to cool, and then mixed with water, it becomes hot, juſt like common quick-lime. As in theſe experiments only very ſmall pieces are uſed, this laſt effect is beſt diſcovered by putting the proof on the outſide of the hand, with a drop of water to it, when inſtantly a very quick heat is felt on the ſkin. When the calcareous ſubſtance is mixed with the vitriolic acid, as in gypſum, or with a clay, as in marle, it commonly melts by itſelf, yet more or leſs difficultly in proportion to the differences of the mixtures. Gypſum produces generally a white, and marle a grey, glaſs or ſlag. When there is any iron in it, as a white iron ore, it becomes dark, and ſometimes quite black, &c.

The *ſiliceæ* never melt alone, but become generally more brittle after being burnt. Such of them as are coloured become colourleſs, and the ſooner when it does not ariſe from any contained metal; for inſtance, the topazes, amethiſts, &c. ſome of the precious ſtones, however, excepted: And ſuch as are mixed with a quantity of iron grow dark in the fire, as ſome of the jaſpers, &c.

Garnets melt always into a black ſlag, and ſometimes ſo eaſily that they may be brought into a round globule upon the charcoal.

The *argillaceæ*, when pure, never melt, but become white and hard. The ſame effects follow when they are mixed with phlogiſton. Thus the ſoap-rock is eaſily cut with the knife; but being burnt it cuts glaſs, and would ſtrike fire with the ſteel, if as large a piece as is neceſſary for that purpoſe could be tried in this way. The ſoap-rocks are ſometimes found of a dark brown and nearly black colour, but nevertheleſs become quite white in the fire like a piece of China ware. However, care muſt be taken not to urge the flame from the top of the wick, there being for the moſt part a ſooty ſmoke, which commonly will darken all that it touches; and, if this is not obſerved, a miſtake in the experiment might eaſily happen. But if it

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it is mixed with iron, as it is fometimes found, it does not fo eafily part with its dark colour. The argillaceæ when mixed with lime melt by themfelves, as abovementioned. When mixed with iron, as in the boles, they grow dark or black; and if the iron is not in too great a quantity, they melt alone into a dark flag; the fame happens when they are mixed with iron and a little of the vitriolic acid, as in the common clay, &c.

Mica and *afbeftos* become fomewhat hard and brittle in the fire, and are more or lefs refractory, though they give fome marks of fufibility.

The *fluors* difcover one of their chief characteriftics by giving a light like phofphorus in the dark, when they are flowly heated; but lofe this property, as well as their colour, as foon as they are made red hot.—They commonly melt in the fire into a white opaque flag, though fome of them not very eafily.

Some forts of the *zeolites* melt eafily, and foam in the fire, fometimes nearly as much as borax, and become a frothy flag, &c.

A great many of thofe mineral bodies which are impregnated with iron, as the *boles*, and fome of the white iron ores, &c. as well as fome of the other iron ores, viz. the bloodftone, are not attracted by the loadftone before they have been thoroughly roafted, &c.

2. *Of fubftances heated with fluxes.* After the mineral bodies have been tried in the fire by themfelves, they ought to be heated with fluxes to difcover if they can be melted or not, and fome other phenomena attending this operation. For this purpofe, three different kinds of falts are ufed as fluxes, viz. fal fodæ, borax, and fal fufible microfmicum; (fee the article *Blow-Pipe*).

The *fal fodæ* is, however, not much ufed in thefe fmall experiments, its effects upon the charcoal rendering it for the moft part unfit for it; becaufe, as foon as the flame begins to act upon it, it melts inftantly, and is almoft wholly abforbed by the charcoal. When this falt is employed to make any experiment, a very little quantity is wanted at once, viz. about the cubical contents of an eighth part of an inch, more or lefs. This is laid upon the charcoal, and the flame blown on it with the blow-pipe; but as this falt commonly is in form of a powder, it is neceffary to go on very gently, that the force of the flame may not difperfe the minute particles of the falt. As foon as it begins to melt, it runs along on the charcoal, almoft like melted tallow; and when cold, it is a glaffy matter of an opaque dull colour fpread on the coal. The moment it is melted, the matter which is to be tried ought to be put into it, becaufe otherwife the greateft part of the falt will be foaked into the charcoal, and too little of it left for the intended purpofe. The flame ought then to be directed on the matter itfelf; and if the falt fpreads too much about, leaving the proof almoft alone, it may be brought to it again by blowing the flame on its extremities, and directing it towards the fubject of the experiment. In the affays made with this falt, it is true, we may find whether the mineral bodies which are melted with it have been diffolved by it or not: but we cannot tell with any certitude whether this is done haftily and with force, or gently and flow; nor whether a lefs or a greater part of the matter has been diffolved: neither can it be well diftinguifhed if the matter has imparted any weak tincture to the flag; becaufe this falt always bubbles upon the charcoal during the experiment, nor is it clear when cool; fo that fcarcely any colour, except it be a vey deep one, can be difcovered, although it may fometimes be coloured by the matter that has been tried.

The following earths are entirely *foluble* in this flux with effervefcence: Agate; chalcedony; carnelian; Turkey ftone †, *(cos Turcica)*; fluor mineralis †; onyx; opal; quartz; common flint; ponderous fpar. The following are *divifible* in it, with or without effervefcence, but not entirely foluble: Amianthus; afbeftus; bafaltes; chryfolite ‡; granate ‡; hornblende; jafper; marlftone; mica; the mineral of alum from Tolfa; petrofilex; aluminous flate and roof flate from Helfingia; emeralds; fteatites; common flint; fchoerl; talc; trapp; tripoli; tourmalin. And the following are neither fufible nor divifible in it: Diamond; hyacinth; ruby; fapphire; topaz.

The other two falts, viz. *borax* and the *fal microcofmicum*, are very well adapted to thefe experiments, becaufe they may by the flame be brought to a clear uncoloured and tranfparent glafs; and as they have no attraction to the charcoal, they keep themfelves always upon it in a round globular form. The fal fufible microfmicum § is very fcarce, and perhaps not to be met with in the fhops; it is made of urine.

§ See *Chemiftry*, n° 905, 906.

The following earths are foluble in borax, with more or lefs *effervefcence:* Fluor mineralis †; marle; mica †; the mineral of alum from Tolfa; aluminous flate, and roof-flate from Helfingia †; ponderous fpar; fchoerl; talc †; tourmalin. And the following *without* effervefcence; Agate; diamond; amianthus; afbeftus; bafaltes; chalcedony; cornelian; chryfolite; cos turcica; granate; hyacinth *; jafper; lapis ponderofus; onyx; opal; petro-filex; quartz *; ruby; fapphire; common flint *; fteatite; trapp; trippel, or tripoli; topaz; zeolite; hydrophanes.

In the microcofmic falt, the following are foluble with more or lefs effervefcence: Bafaltes †; turkey ftone ‡; fluor mineralis †; marle; mica; the mineral of alum from Tolfa; fchiftus aluminaris, fchiftus tegularis from Helfingia †; fchoerl; fpathum ponderofum; tourmalin †; lapis ponderofus. And the following without vifible effervefcence: Agate; diamond; amianthus; afbeftus; chalcedony; carnelian; chryfolite; granate; hyacinth; jafper; onyx ||; opal; petrofilex; quartz ||; ruby; fapphire; common flint ||; emerald; talc; topaz; trapp; trippel; zeolite; hornblend; hydrophanes; lithomarga; fteatites.

Calcareous earth, ponderous fpar, gypfum, and other additaments, often affift the folution, as well in the microcofmic falt as in borax. To which it is neceffary to add, that in order to obferve the effervefcence properly, the matter added to the flux fhould be in the form of a fmall particle rather than in fine powder; becaufe in this laft there is always air between the particles, which being afterwards driven off by the heat afford the appearance of a kind of effervefcence (A).

The

(A) In the above lifts, the articles marked † effervefce very little; thofe marked ‡ not at all; thofe marked * require a larger quantity of the flux and a longer continuance of heat than the reft; thofe marked || are more difficultly diffolved than the others.

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The quantity of thoſe two ſalts required for an experiment is almoſt the ſame as the *ſal ſodæ*; but as the former are cryſtalliſed, and conſequently include a great deal of water, particularly the borax, their bulk is conſiderably reduced when melted, and therefore a little more of them may be taken than the before-mentioned quantity.

Both thoſe ſalts, eſpecially the borax, when expoſed to the flame of the blow-pipe, bubble very much and foam before they melt to a clear glaſs, which for the moſt part depends on the water they contain. And as this would hinder the aſſayer from making due obſervations on the phenomena of the experiment, the ſalt which is to be uſed muſt firſt be brought to a clear glaſs before it can ſerve as a flux; it muſt therefore be kept in the fire until it become ſo tranſparent that the cracks in the charcoal may be ſeen through it. This done, whatſoever is to be tried is put to it, and the fire continued.

Here it is to be obſerved, that for the aſſays made with any of theſe two fluxes on mineral bodies, no larger pieces muſt be taken than that altogether they may keep a globular form upon the charcoal; becauſe it may then be better diſtinguiſhed in what manner the flux acts upon the matter during the experiment. If this be not obſerved, the flux, communicating itſelf with every point of the ſurface of the mineral body, ſpreads all over it, and keeps the form of this laſt, which commonly is flat, and by that means hinders the operator obſerving all the phenomena which may happen. Beſides, the flux being in too ſmall a quantity in proportion to the body to be tried, will be too weak to act with all its force upon it. The beſt proportion therefore is about a third part of the mineral body to the flux; and as the quantity of the flux above mentioned makes a globe of a due ſize in regard to the greateſt heat that is poſſible to procure in theſe experiments, ſo the ſize of the mineral body muſt be a third part leſs here than when it is to be tried in the fire by itſelf.

The *ſal ſodæ*, as has been already obſerved, is not of much uſe in theſe experiments; nor has it any particular qualities in preference to the two laſt mentioned ſalts, except that it diſſolves the zeolites eaſier than they do.

The microcoſmic ſalt ſhows almoſt the ſame effects in the fire as the borax, only differing from it in a very few circumſtances; of which one of the principal is, that, when melted with mangane ſe, it becomes of a crimſon hue inſtead of a jacinth colour, which borax takes. This ſalt is, however, for its ſcarcity ſtill very little in uſe, borax alone being that which is commonly employed. Whenever a mineral body is melted with any of theſe two laſt mentioned ſalts, in the manner already deſcribed, it is eaſily ſeen, Whether it quickly diſſolves; in which caſe an efferveſcence ariſes, that laſts till the whole be diſſolved: Whether the ſolution be ſlowly performed; in which caſe few and ſmall bubbles only riſe from the matter: or, Whether it can be diſſolved at all; becauſe, if not, it is obſerved only to turn round in the flux, without the leaſt bubble, and the edges look as ſharp as they were before.

In order farther to illuſtrate what has been ſaid about theſe experiments, we ſhall give a few examples of the effects of borax upon the mineral bodies.—The *calcareous* ſubſtances, and all thoſe ſtones which contain any thing of lime in their compoſition, diſſolve readily and with efferveſcence in the borax. The efferveſcence is the more violent the greater the portion of lime contained in the ſtone. This cauſe, however, is not the only one in the gypſum, becauſe both the conſtituents of this do readily mix with the borax, and therefore a greater efferveſcence ariſes in melting gypſum with the borax than lime alone.—The *ſiliceæ* do not diſſolve; ſome few excepted which contain a quantity of iron.—The *argillaceæ*, when pure, are not acted upon by the borax: but when they are mixed with ſome heterogeneous bodies, they are diſſolved, though very ſlowly; ſuch are, for inſtance, the ſtone-marrow, the common clay, &c.

The *granates*, *zeolites*, and *trapp*, diſſolve but ſlowly. The *fluors*, *aſbeſtinæ*, and *micaceæ*, diſſolve for the moſt part very eaſily; and ſo forth.—Some of theſe bodies melt to a colourleſs tranſparent glaſs with the borax; for inſtance, the calcareous ſubſtances when pure, the fluors, ſome of the zeolites, &c. Others tinge the borax with a green tranſparent colour, *viz.* the granates, trapp, ſome of the argillaceæ, and ſome of the micaceæ and aſbeſtinæ. This green has its origin partly from a ſmall portion of iron which the granates particularly contain, and partly from phlogiſton.

Borax can only diſſolve a certain quantity of the mineral body proportional to its own. Of the calcareous kind it diſſolves a vaſt quantity; but turns at laſt, when too much has been added, from a clear tranſparent to a white opaque ſlag. When the quantity of the calcareous matter exceeds but little in proportion, the glaſs looks very clear as long as it remains hot: but as ſoon as it begins to cool, a white half opaque cloud is ſeen to ariſe from the bottom, which ſpreads over the third, half, or more of the glaſs globe, in proportion to the quantity of calcareous matter; but the glaſs or ſlag is nevertheleſs ſhining, and of a glaſſy texture when broken. If more of this matter be added, the cloud riſes quicker and is more opaque, and ſo by degrees till the ſlag becomes quite milk white. It is then no more of a ſhining, but rather dry appearance, on the ſurface; is very brittle, and of a grained texture when broken.

SECT. II. *Of Experiments upon Metals and Ores.*

WHAT has been hitherto ſaid relates only to the *ſtones* and *earths*: We ſhall now proceed to deſcribe the manner of examining *metals* and *ores*. An exact knowledge and nicety of procedure are ſo much the more neceſſary here, as the metals are often ſo diſguiſed in their ores, as to be very difficultly known by their external appearance, and liable ſometimes to be miſtaken one for the other: Some of the cobalt ores, for inſtance, reſemble much the *pyrites arſenicalis*; there are alſo ſome iron and lead ores, which are nearly like one another, &c.

As the ores generally conſiſt of metals mineraliſed with ſulphur or arſenic, or ſometimes both together, they ought firſt to be expoſed to the fire by themſelves, in order not only to determine with which of theſe they are mineraliſed, but alſo to ſet them free from thoſe volatile mineraliſing bodies: this ſerves inſtead of calcination, by which they are prepared for further aſſays.

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Here it muſt be repeated, that whenever any metal or fuſible ore is to be tried, a little concavity muſt be made in that place of the charcoal where the matter is to be put; becauſe, as ſoon as it is melted, it forms itſelf into a globular figure, and might then roll from the charcoal, if its ſurface was plain; but when borax is put to it, this inconvenience is not ſo much to be feared.

Whenever an ore is to be tried, a ſmall bit being broke off for the purpoſe, it is laid upon the charcoal, and the flame blown on it ſlowly. Then the ſulphur or arſenic begins to part from it in form of ſmoke: theſe are eaſily diſtinguiſhed from one another by their ſmell; that of ſulphur being ſufficiently known, and the arſenic ſmelling like garlick. The flame ought to be blown very gently as long as any ſmoke is ſeen to part from the ore; but after that, the heat muſt be augmented by degrees, in order to make the calcination as perfect as poſſible. If the heat be applied very ſtrongly from the beginning upon an ore that contains much ſulphur or arſenic, the ore will preſently melt, and yet loſe very little of its mineraliſing bodies, by that means rendering the calcination very imperfect. It is, however, impoſſible to calcine the ores in this manner to the utmoſt perfection, which is eaſily ſeen in the following inſtance, *viz.* in melting down a calcined potter's ore with borax, it will be found to bubble upon the coal, which depends on the ſulphur which is ſtill left, the vitriolic acid of this uniting with the borax, and cauſing this motion. However, lead in its metallic form, melted in this manner, bubbles upon the charcoal, if any ſulphur remains in it. But as the lead, as well as ſome of the other metals, may raiſe bubbles upon the charcoal, although they are quite free from the ſulphur, only by the flames being forced too violently on it, theſe phenomena ought not to be confounded with each other.

The ores being thus calcined, the metals contained in them may be diſcovered, either by being melted alone or with fluxes; when they ſhow themſelves either in their pure metallic ſtate, or by tinging the flag with a colour peculiar to each of them. In theſe experiments it is not to be expected that the quantity of metal contained in the ore ſhould be exactly determined; this muſt be done in larger laboratories. This cannot, however, be looked upon as any defect, ſince it is ſufficient for a mineralogiſt only to find out what ſort of metal is contained in the ore. There is another circumſtance, which is a more real defect in the miniature laboratories, which is, that ſome ores are not at all capable of being tried by ſo ſmall an apparatus; for inſtance, the gold ore called *pyrites aureus*, which conſiſts of gold, iron, and ſulphur. The greateſt quantity of gold which this ore contains is about one ounce, or one ounce and an half, out of 100 pounds of the ore, the reſt being iron and ſulphur: and as only a very ſmall bit is allowed for theſe experiments, the gold contained therein can hardly be diſcerned by the eye, even if it could be extracted; but it goes along with the iron in the flag, this laſt metal being in ſo large a quantity in proportion to the other, and both of them having an attraction for each other.

The blendes and black-jacks, which are mineral zinc ores, containing zinc, ſulphur, and iron, cannot be tried this way, becauſe they cannot be perfectly calcined, and beſides the zinc flies off when the iron ſcorifies. Neither can thoſe blendes, which contain ſilver or gold mineraliſed with them, be tried in this manner, which is particularly owing to the imperfect calcination. Nor are the quickſilver ores fit for theſe experiments; the volatility of that ſemimetal making it impoſſible to bring it out of the poorer ſort of ores; and the rich ores, which ſweat out the quickſilver when kept cloſe in the hand, not wanting any of theſe aſſays, &c. Thoſe ores ought to be aſſayed in larger quantities, and even with ſuch other methods as cannot be applied upon a piece of charcoal.

Some of the rich ſilver ores are eaſily tried: for inſtance, *minera argenti vitrea*, commonly called *ſilver-glaſs*, which conſiſts only of ſilver and ſulphur. When this ore is expoſed to the flame, it melts inſtantly, and the ſulphur goes away in fume, leaving the ſilver pure upon the charcoal in a globular form. If this ſilver ſhould happen to be of a dirty appearance, which often is the caſe, then it muſt be melted anew with a very little borax; and after it has been kept in fuſion for a minute or two, ſo as to be perfectly melted and red-hot, the proof is ſuffered to cool: it may then be taken off the coal; and being laid upon the ſteel-plate†, the ſilver is ſeparated from the ſlag by one or two ſtrokes of the hammer†. Here the uſe of the braſs ring† is manifeſt; for this ought firſt to be placed upon the plate, to hinder the proof from flying off by the violence of the ſtroke, which otherwiſe would happen. The ſilver is then found incloſed in the ſlag of a globular form, and quite ſhining, as if it was poliſhed. When a large quantity of ſilver is contained in a lead ore, *viz.* in a potter's ore, it can likewiſe be diſcovered through the uſe of the blow-pipe, of which more will be mentioned hereafter.

† See the article Blow-Pipe, and Plate XCIX.

Tin may be melted out of the pure tin ores in its metallic ſtate. Some of theſe ores melt very eaſily, and yield their metal in quantity, if only expoſed to the fire by themſelves: but others are more refractory; and as theſe melt very ſlowly, the tin, which ſweats out in form of very ſmall globules, is inſtantly burnt to aſhes before theſe globules have time to unite in order to compoſe a larger globe, which might be ſeen by the eye, and not ſo ſoon deſtroyed by the fire; it is therefore neceſſary to add a little borax to theſe from the beginning, and then to blow the flame violently at the proof. The borax does here preſerve the metal from being too ſoon calcined, and even contributes to the readier collecting of the ſmall metallic particles, which ſoon are ſeen to form themſelves into a globule of metallic tin at the bottom of the whole maſs, neareſt to the charcoal. As ſoon as ſo much of the metallic tin is produced as is ſufficient to convince the operator of its preſence, the fire ought to be diſcontinued, though the whole of the ore be not yet melted; becauſe the whole of this kind of ore can be ſeldom or never reduced into metal by means of theſe experiments, a great proportion being always calcined: and if the fire is continued too long, perhaps even the metal already reduced may likewiſe be burnt to aſhes; for the tin is very ſoon deprived of its metallic ſtate by the fire.

Moſt part of the lead ores may be reduced to a metallic ſtate upon the charcoal. The *mineræ plumbi calciformes*, which are pure, are eaſily melted into lead; but

but fuch of them as are mixed with an *ochra ferri*, or any kind of earth, as clay, lime, &c. yield very little of lead, and even nothing at all, if the heterogenea are combined in any large quantity: this happens even with the *minera plumbi calciformis arfenico mixta*. Thefe therefore are not to be tried but in larger laboratories. However, every mineral body fufpected to contain any metallic fubftance may be tried by the blow-pipe, fo as to give fufficient proofs whether it contain any or not, by its effects being different from thofe of the ftones or earths, &c.

The *mineræ plumbi mineralifatæ* leave the lead in a metallic form, if not too large a quantity of iron is mixed with it. For example, when a teffellated or fteel-grained lead ore is expofed to the flame, its fulphur, and even the arfenic if there be any, begins to fume, and the ore itfelf immediately to melt into a globular form; the reft of the fulphur continues then to fly off, if the flame be blown flowly upon the mafs; but, on the contrary, very little of the fulphur will go off, if the flame be forced violently on it: in this cafe, it rather happens that the lead itfelf crackles and diffipates, throwing about very minute metallic particles. The fulphur being driven out as much as poffible, which is known by finding no fulphureous vapour in fmelling at the proof, the whole is fuffered to cool, and then a globule of metallic lead will be left upon the coal. If any iron is contained in the lead-ore, the lead, which is melted out of it, is not of a metallic fhining, but rather of a black and uneven, furface: a little borax muft in this cafe be melted with it, and as foon as no bubble is feen to rife any longer from the metal into the borax, the fire muft be difcontinued: when the mafs is grown cold, the iron will be found fcorified with the borax, and the lead left pure and of a fhining colour.

Borax does not fcorify the lead in thefe fmall experiments when it is pure: if the flame is forced with a violence on it, a bubbling will enfue, refembling that which is obferved when borax diffolves a body melted with it; but when the fire ceafes, the flag will be perfectly clear and tranfparent, and a quantity of very minute particles of lead will be feen fpread about the borax, which have been torn off from the mafs during the bubbling.

If fuch a lead ore is rich in filver, this laft metal may likewife be difcovered by this experiment; becaufe as the lead is volatile, it may be forced off, and the filver remain. To effect this, the lead, which is melted out of the ore, muft be kept in conftant fufion with a flow heat, that it may be confumed. This end will be fooner obtained, and the lead part quicker, if during the fufion the wind through the blow-pipe be directed immediately, though not forcibly, upon the melted mafs itfelf, until it begin to cool; at which time the fire muft be directed on it again. The lead, which is already in a volatilifing ftate, will by this artifice be driven out in form of a fubtil fmoke; and by thus continuing by turns to melt the mafs, and then to blow off the lead, as has been faid, until no fmoke is any longer perceived, the filver will at laft be obtained pure. The fame obfervation holds good here alfo, which was made about the gold, that, as none but very little bits of ores can be employed in thefe experiments, it will be difficult to extract the filver out of a poor ore; for fome part of it will fly off with the lead, and what might be left is too fmall to be difcerned by the eye. The filver, which by this means is obtained, is eafily diftinguifhed from lead by the following external marks, *viz.* that it muft be red-hot before it can be melted: it cools fooner than lead: it has a filver colour; that is to fay, brighter and whiter than lead: and is harder under the hammer.

The *mineræ cupri calciformes* (at leaft fome of them), when not mixed with too much ftone or earth, are eafily reduced to copper with any flux; if the copper is found not to have its natural bright colour, it muft be melted with a little borax, which purifies it. Some of thefe ores do not all difcover their metal if not immediately melted with borax; the heterogenea contained in them hindering the fufion before thefe are fcorified by the flux.

The grey copper ores, which only confift of copper and fulphur, are tried almoft in the fame manner as above mentioned. Being expofed to the flame by themfelves, they will be found inftantly to melt, and part of their fulphur to go off. The copper may afterwards be obtained in two ways: the one, by keeping the proof in fufion for about a minute, and afterwards fuffering it to cool; when it will be found to have a dark and uneven appearance externally, but which after being broken difcovers the metallic copper of a globular form in its centre, furrounded with a regulus, which ftill contains fome fulphur and a portion of the metal: the other, by being melted with borax, which laft way fometimes makes the metal appear fooner.

The *mineræ cupri pyritaceæ*, containing copper, fulphur, and iron, may be tried with the blow-pipe if they are not too poor. In thefe experiments the ore ought to be calcined, and after that the iron fcorified. For this purpofe a bit of the ore muft be expofed to a flow flame, that as much of the fulphur as poffible may part from it before it is melted, becaufe the ore commonly melts very foon, and then the fulphur is more difficultly driven off. After being melted, it muft be kept in fufion with a ftrong fire for about a minute, that a great part of the iron may be calcined; and after that, fome borax muft be added, which fcorifies the iron, and turns with it to a black flag. If the ore is very rich, metallic copper will be had in the flag after the fcorification. If the ore be of a moderate richnefs, the copper will ftill retain a little fulphur, and fometimes iron: the product will therefore be brittle, and muft with great caution be feparated from the flag, that it may not break into pieces; and if this product is afterwards treated in the fame manner as before faid, in fpeaking of the grey copper-ores, the metal will foon be produced. But if the ore is poor, the product after the firft fcorification muft be brought into fufion, and afterwards melted with fome frefh borax, in order to calcine and fcorify the remaining portion of iron; after which it may be treated as mentioned in the preceding paragraph. The copper will in this laft cafe be found in a very fmall globule.

The copper is not very eafily fcorified with this apparatus, when it is melted together with borax, unlefs it has firft been expofed to the fire by itfelf for a while in order to be calcined. When only a little of this metal is diffolved, it inftantly tinges the flag of a red-

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diſh brown colour, and moſtly opaque ; but as ſoon as this flag is kept in fuſion for a little while, it becomes quite green and tranſparent : and thus the preſence of the copper may be diſcovered by the colour, when it is concealed in heterogeneous bodies, ſo as not to be diſcovered by any other experiment.

If metallic copper is melted with borax by a flow fire, and only for a very little time, the glaſs or flag becomes of a fine tranſparent blue or violet colour, inclining more or leſs to the green : but this colour is not properly owing to the copper, but it may rather be to its phlogiſton ; becauſe the ſame colour is to be had in the ſame manner from iron ; and theſe glaſſes, which are coloured with either of thoſe two metals, ſoon loſe their colour if expoſed to a ſtrong fire, in which they become quite clear and colourleſs. Beſides, if this glaſs, tinged blue with the copper, is again melted with more of this metal, it becomes of a good green colour, which for a long time keeps unchanged in the fire.

The iron ores, when pure, can never be melted *per ſe*, by the means of the blow-pipe alone ; nor do they yield their metal when melted with fluxes; becauſe they require too ſtrong a heat to be brought into fuſion ; and as both the ore and the metal itſelf very ſoon loſe their phlogiſton in the fire, and cannot be ſupplied with a ſufficient quantity from the charcoal, ſo likewiſe they are very ſoon calcined in the fire. This eaſy calcination is alſo the reaſon why the fluxes, for inſtance borax, readily ſcorify this ore, and even the metal itſelf. The iron loſes its phlogiſton in the fire ſooner than the copper, and is therefore more eaſily ſcorified.

The iron is, however, diſcovered without much difficulty, although it were mixed but in a very ſmall quantity with heterogeneous bodies. The ore, or thoſe bodies which contain any large quantity of the metal, are all attracted by the loadſtone, ſome without any previous calcination, and others without having being roaſted. When a clay is mixed with a little iron, it commonly melts by itſelf in the fire ; but if this metal is contained in a limeſtone, it does not promote the fuſion, but gives the ſtone a dark and ſometimes a deep black colour, which always is the character of iron. A *minera ferri calciformis pura cryſtalliſata*, is commonly of a red colour : This being expoſed to the flame, becomes quite black ; and is then readily attracted by the loadſtone, which it was not before. Beſides theſe ſigns, the iron diſcovers itſelf, by tinging the flag of a green tranſparent colour, inclining to brown, when only a little of the metal is ſcorified; but as ſoon as any larger quantity thereof is diſſolved in the flag, this becomes firſt a blackiſh brown, and afterwards quite black and opaque.

Biſmuth is known by its communicating a yellowiſh brown colour to borax ; and arſenic by its volatility and garlick ſmell. Antimony, both in form of regulus and ore, is wholly volatile in the fire when it is not mixed with any other metal except arſenic; and is known by its particular ſmell, eaſier to be diſtinguiſhed when once known than deſcribed. When the ore of antimony is melted upon the charcoal, it bubbles conſtantly during its volatiliſing.

Zinc ores are not eaſily tried upon the coal ; but the regulus of zinc expoſed to the fire upon the charcoal burns with a beautiful blue flame, and forms itſelf almoſt inſtantly into white flowers, which are the common flowers of zinc.

Cobalt is particularly remarkable for giving to the glaſs a blue colour, which is the zaffre or ſmalt. To produce this, a piece of cobalt ore muſt be calcined in the fire, and afterwards melted with borax. As ſoon as the glaſs, during the fuſion, from being clear, ſeems to grow opaque, it is a ſign that it is already tinged a little ; the fire is then to be diſcontinued, and the operator muſt take hold, with the nippers, of a little of the glaſs, whilſt yet hot, and draw it out ſlowly in the beginning, but afterwards very quick, before it cools, whereby a thread of the coloured glaſs is procured, more or leſs thick, wherein the colour may eaſier be ſeen than in a globular form. This thread melts eaſily, if only put in the flame of the candle without the help of the blow-pipe.—If this glaſs be melted again with more of the cobalt, and kept in fuſion for a while, the colour becomes very deep ; and thus the colour may be altered at pleaſure.

When the cobalt ore is pure, or at leaſt contains but little iron, a cobalt regulus is almoſt inſtantly produced in the borax during the fuſion ; but when it is mixed with a quantity of iron, this laſt metal ought firſt to be ſeparated, which is eaſily performed ſince it ſcorifies ſooner than the cobalt ; therefore, as long as the flag retains any brown or black colour, it muſt be ſeparated, and melted again with freſh borax, until it ſhows the blue colour.

Nickel is very ſeldom to be had; and as its ores are ſeldom free from mixtures of other metals, it is very difficultly tried with the blow-pipe. However, when this ſemimetal is mixed with iron and cobalt, it is eaſily freed from theſe heterogeneous metals, and reduced to a pure nickel regulus by means of ſcorification with borax, becauſe both the iron and cobalt ſooner ſcorify than the nickel. The regulus of nickel itſelf is of a green colour when calcined : it requires a pretty ſtrong fire before it melts, and tinges the borax with a hyacinth colour. Mangancſe gives the ſame colour to borax ; but its other qualities are quite different, ſo as not be confounded with the nickel.

By means of the foregoing explanations, and thoſe given under the article *Blow-Pipe*, any gentleman, who is a lover of this ſcience, will be able, in an eaſy manner, to amuſe himſelf in diſcovering the properties of thoſe works of nature, with which the mineral kingdom furniſhes us ; or more uſefully to employ himſelf by finding out what ſorts of ſtones, earths, ores, &c. there are on his eſtate, and to what economical purpoſes they may be employed. The ſcientific mineraliſt may, by examining into the properties and effects of the mineral bodies, diſcover the natural relation theſe bodies ſtand in to each other, and thereby furniſh himſelf with materials for eſtabliſhing a mineral ſyſtem, founded on ſuch principles as Nature herſelf has laid down in them ; and this in his own ſtudy, without being forced to have recourſe to great laboratories, crucibles, furnaces. &c. which is attended with much trouble, and is the reaſon why ſo few can have an opportunity of gratifying their deſire of knowledge in this

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this part of natural hiſtory. Farther improvements of this apparatus may ſtill be made by thoſe who chooſe to beſtow their attention upon it.

A great number of fluxes might, perhaps, be found out, whoſe effects might be different from thoſe already in uſe, whereby more diſtinct characters of thoſe mineral bodies might be diſcovered, which now either ſhow ambiguous ones, or which it is almoſt impoſſible to try exactly with the blow-pipe. Inſtead of the *ſal ſodæ*, ſome other ſalt might be diſcovered better adapted to theſe experiments. But it is very neceſſary not to make uſe of any other fluxes on the charcoal than ſuch as have no attraction to it: if they, at the ſame time, be clear and tranſparent, when melted, as the borax and the *ſal fuſibile microcoſmicum*, it is ſtill better: however, the tranſparency and opacity are of no great conſequence, if a ſubſtance be eſſayed only in order to diſcover its fuſibility, without any attention to its colour; in which caſe, ſome metallic ſlag, perhaps, might be uſeful.

When ſuch ores are to be reduced whoſe metals are very eaſily calcined, as tin, zinc, &c. it might perhaps be of ſervice to add ſome phlogiſtic body, ſuch as hard reſin, ſince the charcoal cannot afford enough of it in the open fire of theſe eſſays. The manner of melting the volatile metals out of their ores *per deſcenſum* might alſo, perhaps, be imitated: for inſtance, a hole might be made in the charcoal, wide above and very narrow at the bottom; a little piece of the ore being then laid at the upper end of the hole, and covered with ſome very ſmall pieces of the charcoal, the flame muſt be directed on the top: the metal might, perhaps, by this method, run into the hole below, concealed from the violence of the fire, particularly if the ore is very fuſible, &c.

The uſe of the apparatus above referred to, and which may be called a *pocket laboratory* (as the whole admits of being eaſily packed into a ſmall caſe), is chiefly calculated for a travelling mineraliſt. But a perſon who always reſides at one and the ſame place, may by ſome alteration make it more commodious to himſelf, and avoid the trouble of blowing with the mouth. For this purpoſe he may have the blow-pipe go through a hole in a table, and fixed underneath to a ſmall pair of bellows with double bottoms, ſuch as ſome of the glaſs-blowers uſe, and then nothing more is required than to move the bellows with the feet during the experiment; but in this caſe a lamp may be uſed inſtead of a candle. This method would be attended with a ſtill greater advantage, if there were many ſuch parts as *c*, fig. 13. the openings of which were of different dimenſions: thoſe parts might by means of a ſcrew be faſtened to the main body of the blow-pipe, and taken away at pleaſure. The advantage of having theſe nozzles of different capacities at their ends, would be that of exciting a ſtronger or weaker heat as occaſion might require. It would only be neceſſary to obſerve, that in proportion as the opening or nozzle of the pipe is enlarged, the quantity of the flame muſt be augmented by a thicker wick in the lamp, and the force of blowing encreaſed by means of weights laid on the bellows; a much intenſer heat would thus be produced by a pipe of a conſiderable opening at the end, by which the experiments muſt undoubtedly be carried farther than the common blow-pipe.

Plate CCXIII.

A traveller, who has ſeldom an opportunity of carrying many things along with him, may very well be contented with this laboratory and its apparatus, which are ſufficient for moſt part of ſuch experiments as can be made on a journey. There are, however, other things very uſeful to have at hand on a journey, which ought to make a ſeparate part of a portable laboratory, if the manner of travelling does not oppoſe it: this conſiſts of a little box including the different acids, and one or two matraſſes, in order to try the mineral bodies in liquid menſtrua if required.

Theſe acids are, the acid of nitre, of vitriol, and of common ſalt. Moſt of the ſtones and earths are attacked, at leaſt in ſome degree, by the acids; but the calcareous are the eaſieſt of all to be diſſolved by them, which is accounted for by their calcareous properties. The acid of nitre is that which is moſt uſed in theſe experiments; it diſſolves the limeſtone, when pure, perfectly, with a violent effervefcence, and the ſolution becomes clear: when the limeſtone enters into ſome other body, it is nevertheleſs diſcovered by this acid, through a greater or leſs effervefcence in proportion to the quantity of the calcareous particles, unleſs there are ſo few as to be almoſt concealed from the acid by the heterogeneous ones. In this manner a calcareous body, which ſometimes nearly reſembles a ſiliceous or argillaceous one, may be known from theſe latter, without the help of the blow-pipe, only by pouring one or two drops of this acid upon the ſubject; which is very convenient when there is no opportunity nor time of uſing this inſtrument.

The gypſa, which conſiſt of lime and the vitriolic acid, are not in the leaſt attacked by the acid of nitre, if they contain a ſufficient quantity of their own acid; becauſe the vitriolic acid has a ſtronger attraction to the lime than the acid of nitre: but if the calcareous ſubſtance is not perfectly ſaturated with the acid of vitriol, then an effervefcence ariſes with the acid of nitre, more or leſs in proportion to the want of the vitriolic acid. Theſe circumſtances are often very eſſential in diſtinguiſhing the *calcarea* and *gypſa* from one another.

The acid of nitre is likewiſe neceſſary in trying the zeolites, of which ſome ſpecies have the ſingular effect to diſſolve with effervefcence in the above mentioned acid; and within a quarter of an hour, or even ſometimes not until ſeveral hours after, to change the whole ſolution into a clear jelly, of ſo firm a conſiſtence, that the glaſs wherein it is contained may be reverſed without its falling out.

If any mineral body is tried in this menſtruum, and only a ſmall quantity is ſuſpected to be diſſolved, though it was impoſſible to diſtinguiſh it with the eye during the ſolution, it can be eaſily diſcovered by adding to it *ad ſaturitatem* a clear ſolution of the alkali, when the diſſolved part will be precipitated, and fall to the bottom. For this purpoſe the *ſal ſodæ* may be very uſeful.

The acid of nitre will ſuffice for making experiments upon ſtones and earths; but if the experiments are to be extended to the metals, the other two acids are alſo neceſſary.

Another inſtrument is likewiſe neceſſary to a complete

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complete Pocket-Laboratory, viz. a washing-trough (fig. 21.), in which the mineral bodies, and particularly the ores, may be separated from each other, and from the adherent rock, by means of water. This trough is very common in laboratories, and is used of different sizes; but here only one is required of a moderate size, such as 12 inches and a half long, three inches broad at the one end and one inch and a half at the other end, sloping down from the sides and the broad end to the bottom, where it is three quarters of an inch deep. It may, however, be made of much smaller dimensions. It is commonly made of wood, which ought to be chosen smooth, hard, and compact, wherein are no pores in which the minute grains of the pounded matter may conceal themselves. It is to be observed, that if any such matter is to be washed as is suspected to contain some native metal, such as silver or gold, a trough should be procured for this purpose of a very shallow slope; because the minute particles of the native metal have then more power to assemble together at the broad end, and separate from the other matter.

The management of this trough, or the manner of washing, consists in this: That when the matter is mixed with about three or four times its quantity of water in the trough, this is kept very loose between two fingers of the left hand, and some light strokes given on its broad end with the right, that it may move backwards and forwards; by which means the heaviest particles assemble at the broad and lower end, from which the lighter ones are to be separated by inclining the trough and pouring a little water on them. By repeating this process, all such particles as are of the same gravity may be collected together, and separated from those of different gravity, provided they were before equally pounded: though such as are of a clayey nature, are often very difficult to separate from the rest, which, however, is of no great consequence to a skilful and experienced washer. The washing process is very necessary, as there are often rich ores, and even native metals, found concealed in earths and sand in such minute particles as not to be discovered by any other means.

Sect. III. *Description of an Improved Portable Laboratory for assaying Minerals.*

The chief pieces and implements of the portable laboratories are represented in Plate XCIX. at *Blow-Pipe*, and in Plate CCCXIII. annexed to the present article.

I. The first contains those belonging to the *Dry* Laboratory, so called on account of its containing whatever is required to try all kinds of fossils in the dry way by fire, without any of the humid menstruums. They are made to pack in a box of the size of an octavo book, lined with green velvet, and covered with black fish-skin; the inside divided into different compartments, suited to the size, form, and number of the implements it is to contain. Of these the principal are described under *Blow-Pipe*. We must here, however, add the following remarks and alterations of that instrument by Mr Magellan.

Plate CCCXIII.

D and Q (fig. 13.) are the two pieces that form the blow-pipe, which is here represented entire. This very useful instrument has been considerably improved of late in England. The mouth-piece *aa* is made of ivory, to avoid the disagreeable sensation of having a piece of metal a long time between the teeth and lips, which, if not of silver or gold, may be very noxious to the operator; a circumstance that has been hardly noticed before.

1. If the mouth-piece *aa* be made of a round form, it cannot be held for any length of time between the teeth and lips, to blow through it, without straining the muscles of the mouth, which produces a painful sensation. It must, therefore, have such an external figure, as to adapt itself accurately to the lateral angles of the lips, having a flattish oval form externally, with two opposite corners to fit those internal angles of the mouth, when it is held between the lips, as may be seen in that represented in the figure.

2. The small globe *bb* is hollow, for receiving the moisture of the breath; and must be composed of two hemispheres, exactly screwing into one another in *bb*; the male-screw is to be in the lower part, and soldered on the crooked part Q of the tube Q D, at such a distance, that the inside end of the crooked tube be even with the edge of the hemisphere, as represented by the pointed lines in the figure. But the upper hemisphere is to be soldered at the end of the straight tube D. By these means, the moisture arising from the breath falls into the hollow of the lower hemisphere, where it is collected round the upper inside end of the crooked part Q of the blow-pipe, without being apt to fall into it.

3. The small nozzles, or hollow conical tubes, advised by Messrs Engestrom, Bergman, and others, are wrong in the principle; because the wind that passes from the mouth through such long cones loses its velocity by the lateral friction, as happens in hydraulic spouts; which, when formed in this manner, do never throw the fluid so far as when the fluid passes through a hole of the same diameter, made in a thin plate of a little metallic cap that screws at the end of the large pipe. It is on this account that the little cap *c* is employed, having a small hole in the thin plate, which serves as a cover to it; and there are several of these little caps, with holes of smaller and larger sizes, to be changed and applied whenever a flame is required to be more or less strong.

4. Another convenience of these little caps is, that even in case any moisture should escape falling into the hemisphere *bb*, and pass along with the wind through the crooked pipe Q, it never can arrive at nor obstruct the little hole of the cap *c*, there being room enough under the hole in the inside, where this moisture must be stopped till it is cleaned and wiped out.

The stream of air that is impelled by the blow-pipe (as seen in fig. 3.) upon the flame, must be constant and even, and must last as long as the experiment continues to require it. This labour will fatigue the lungs, unless an equable and uninterrupted inspiration can at the same time be continued. To succeed in this operation without inconvenience, some labour and practice are necessary, as already explained under the detached article.

Every assay ought always to begin by the exterior flame, which must be first directed upon the mass under examination; and, when its efficacy is well known, then the interior blue flame is to be employed.

After

rtable aratus. After the ore is roasted, it is to be rounded upon the steel plate by the hammer; the particles being prevented from being dissipated by the ring H (fig. 9. Plate XCIX.), within which the pieces to be broken are to be put.

Among the apparatus, beside the particulars already mentioned, three phials are necessary, containing the required fluxes, viz. the *borax*, the *sal sodæ*, and *sal fusibile microcosmicum*. Other useful particulars are, A small link of hard steel, to try the hardness or softness of mineral substances, and also to strike fire for lighting the candle when required: A piece of black flint, to serve as a touch-stone; (for being rubbed with any metal, if it be gold the marks will not be corroded by aqua fortis); and also to strike fire, when necessary, with the link of steel: An artificial loadstone, properly armed with iron, for the better preservation of its attractive power; (it serves to discover the ferrugineous particles of any ore after it has been roasted and powdered :) A triple magnifier, which, differently combined, produces seven magnifying powers, the better to distinguish the structure and metallic parts of ores, and the minute particles of native gold, whenever they contain that metal: A file, to try the hardness of stones and crystals, &c.: Some pieces of dry agaric or tinder, and small bits or splinters of wood tipped with brimstone, to serve as matches for lighting the candle; and various other little articles of use in these experiments.

II. For performing experiments in the *Humid Way*, the chief additional articles (and which must be kep in a separare case) consist of a collection of phials, containing the principal acids, tests, precipitants, and re-agents, both for examining mineral bodies by the humid way, and for analysing the various kinds of mineral waters. Those with acids and corrosive solutions have not only ground stoples, but also an external cap to each, ground over the stople, and secured downward by a bit of wax between both, in order to confine the corrosive and volatile fluids within. But those which contain mild fluid liquors have not such external caps; and those with dry inoffensive substances are only stopped with cork. Besides these phials, there are two smaller cylindrical ones, which serve to exhibit the changes of colour produced by some of the reagents in those analytical assays. There are also two or three small matrasses, to hold the substances with their solvents over the fire; a small glass funnel for pouring the fluids; a small porcelain mortar, with its pestle; one or two crucibles of the same substance; a small wooden trough to wash the ground ores; some glass sticks to stir up the fluid mixtures; and, finally, pieces of paper tinged red, yellow, and blue, by the tinctures of Fernambuc wood (commonly called Brasil wood), turmeric, and litmus, thickened with a little starch.

The following list contains the names of the various fluid tests and re-agents that are necessary for these assays. But the whole number being too large to be all contained in a portable case, every one may give the preference to those he likes best.

1. Concentrated vitriolic acid, whose specific gravity may be expressed in the outside.
2. Nitrous acid, purified by the nitrous solution of silver.
3. Concentrated marine acid, with its specific gravity.
4. Marine acid dephlogisticated.
5. Aqua regia for gold, viz. 2 nit. and 1 marine.
6. Aqua regia for platina, viz. half marine and half nitrous acid.
7. Nitrous solution of silver.
8. Nitrous solution of mercury, made in the cold.
9. Muriatic solution of barytes.
10. Nitrous solution of lime.
11. Muriatic solution of lime.
12. Mercury in its metallic state.
13. Corrosive sublimate of mercury
14. White arsenic.
15. Nitrous solution of silver.
16. Nitrous solution of copper.
17. Acid of sugar.
18. Liquor probatorius vini.
19. Hepar sulphuris.
20. Oil of tartar *per deliquium*.
21. Salt of tartar.
22. Caustic vegetable alkali.
23. Pearl-ashes.
24. Soap-makers ley.
25. Common salt.
26. Vitriolated argilla (alum.)
27. Vitriol of iron (copperas.)
28. Nitrous solution of silver.
29. Acetous solution of lead
30. Acetous solution of barytes.
31. Phlogisticated alkali by the Prussian blue.
32. Lime-water.
33. Lime-water phlogisticated by the Prussian blue.
34. Caustic volatil alkali.
35. Mild volatile alkali (dry)
36. Rectified spirit (alcohol)
37. Æther.
38. Spirituous tincture of galls.

The following tests are very fit also for these assays, viz. 39. Spirituous solutions of soap; 40. Syrup of violets; 41. Tincture of litmus; 42. Tincture of Brasil wood; 43. Tincture of turmeric; 44. Oil of olives; 45. Oil of linseed; 46. Oil of turpentine; 47. Essential salt of wild-sorrel; 48. Hepar sulphuris; 49. Sugar of lead; 50. Solution of alum.

The method of applying the above tests of acids and re-agents may be seen in Bergman's treatises of the Analysis of Waters, and of Assaying by the Humid Way; in Kirwan's Elements of Mineralogy; in the Elements of Chemistry of Dijon; in the Memoirs of the same Academy; in Fourcroy's Lectures of Chemistry, &c.

III. The *Lamp-furnace* Laboratory, for experiments both by the *humid* and the *dry* way, is a very curious and useful, though small apparatus. It is an improvement of that which was contrived by M. de Morveau, in consequence of the information he received from his friend the president de Virly, who saw at Upsal how advantageously the late eminent professor Bergman availed himself of this convenience for many analytical processes in miniature, by the use of very small glass vessels about one inch diameter, and other implements of proportional size, for performing various chemical operations. (See the Dijon Memoirs for 1783, Part 1. p. 171.)

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There can be no doubt but that whenever these processes are properly conducted, though in miniature, the lamp-furnace will prove amply sufficient to perform in a few minutes, and with very little expence, the various solutions, digestions, and distillations, which otherwise would require large vessels, stills, retorts, reverberatory furnaces, &c. to ascertain the component parts of natural bodies; though it is not always sufficient to ascertain their respective quantities. In this last case, operations must be performed in great laboratories, and on a large scale, at a considerable expence. But the substances are sometimes too valuable; as, for instance, when precious stones are examined; and of course the last way never can be attempted in such cases.

These small processes have likewise another advantage before noticed, which cannot be obtained in works at large. It consists in one's being able to observe the gradual progress of each operation; of easily retarding or urging it, as it may require; and of ascertaining at pleasure each step of every experiment, together with the phenomena attending the same.

The lamp-furnace is mounted in a small parallelogram of mahogany, about six inches long and four wide, marked fig. 5. This is kept steady over the edge of a common table, by means of the metallic clamp *ww*, which is fastened by the screw *x*. The pillar *rs* is screwed in a vertical position on the plate *s*, being about ten inches high; the other is screwed to the opposite corner, marked *pk*, and is only $7\frac{1}{2}$ inches long; both are composed of two halves, that screw at *tt*, to be easily packed up with all the implements in a case covered with black fish-skin, and lined with green velvet, like the other laboratory already described.

Plate CCCXIII.

The lamp *k*, fig. 3. is supported on the plate *f*, which has a ring *l* that runs in the column *pk*, and may be fixed by its screw *l* at the required height.—This lamp has three small pipes of different sizes, to receive as many wicks of different thickness, and to be filled with spirit of wine. By a similar method, a piece of charcoal is mounted and supported by the pliers or little forceps screwed to the arm *ac*, fig. 1. which has all the motions requisite for being fixed by means of proper screws, at a proper distance from the flame of the wick *h*. The blow-pipe, fig. 4. is, by a similar mechanism, mounted on the smaller column *pq*, at such a distance as to blow the flame *hi* to the piece of ore *m*, which is upon the charcoal *gf*.

Every thing being disposed in this manner, the operator blows through the mouth-piece of the blowpipe, fig. 4. and remains with his hands free to make the changes and alterations he may think proper.—

[*N. B.* The large round cavity *e* in the middle of the parallelogram, fig. 5. is to receive the lamp *k*, fig. 3. when all the implements are packed up in their case of black fish-skin; and the cover of the lamp is represented by fig. 12.]

But if the operator has the double bellows, fig. 14. and 15. he fixes them, at a due distance, to the same table by the brass clamp *y*. He then unscrews the blow-pipe at *zz*: joins the mouth *m* of the flexible tube to the hemisphere *z z*, passing each orifice, thro' the leather tube fig. 11. and tying both ends with a waxed thin pack-thread. If he works with his foot on the pedal, the string of which is seen hanging from the end of the bellows, fig. 15. (and is always up, on account of the weight *e*), then the air is absorbed by the bellows fig. 15. from whence it is propelled by the motion of the foot on the pedal to the bellows, fig. 14. whose constant weight *r* drives it out through the flexible pipe, fig. 10. it of course enters the curbed part *zzi* of the blow-pipe, and drives the flame on the piece *m* of the ore, that is to be examined upon the charcoal.

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[*N. B.* 1. This double bellows is packed up by itself in a mahogany case, about 9 inches long, $6\frac{1}{2}$ wide, and about $3\frac{1}{4}$ deep, outside measure. 2. The last blowing bellows, fig. 14. has an inside valve, which opens when the upper surface of it is at its greatest height; in order to let the superfluous air escape out, as it would otherwise issue with great velocity out of the tube, fig. 11. and spoil the operation.]

If the operator chooses to apply the vital or dephlogisticated air in his process, let him fill the glass-jar *h*, fig. 17. with this air; and put it within the tub marked by *abze*, filled with water, fastening the neck of the jar within by a cross-board *ed*, which has a hole in it for that purpose; then introducing the two ends of the flexible hollow tube, fig. 16. both to the mouth of the jar and to the hole of the bellows fig. 15. he opens the hole *m* of the jar, that was stopped with the stople *n*; the column of the water passes in through *m*, and forces up the vital air, which enters the bellows, and of course, by the alternate motion of the pedal, passes through the end of the blow-pipe, to urge the flame upon the piece of ore *m*, fig. 2. on the charcoal *g*. But the dephlogisticated air may be also received at the same time that it is produced, by tying the pipe, fig. 16. to the mouth of an earthen retort, or even of a glass retort well-coated, according to the method of Mr Willis, described in the Transactions of the Society of Arts, Vol. V. p. 96. This last consists in dissolving two ounces of borax in a pint of boiling water, and adding to the solution as much slacked lime as is necessary to form a thin paste. this glass retort is to be covered all over with it, by means of a painter's brush, and then suffered to dry. It must then be covered with a thin paste made of linseed oil and slacked lime, except the neck that enters into the receiver. In two or three days it will dry of itself; and the retort will then bear the greatest fire without cracking. Two ounces of good nitre, being urged in the retort, by a good fire on a chafingdish, will afford about 700 or 800 ounce-measures of dephlogisticated air.

To make any other kind of chemical assays, the forceps of fig. 2. which supports the charcoal, is taken off, by unscrewing the screw *b*; the blow-pipe is also taken off, by loosening the screw *n*; the hoop fig. 7. is put in its place, where the metallic basin of fig. 19. is put filled with sand: the piece of fig. 8. is set on the other pillar *rs*, fig. 1. to hold the matrass, fig. 18. upright, or the receiver fig. 20. &c.

In the same manner, the retort, fig. 9. may be put in the sand-bath instead of the matrass, with its receiver fig. 20. which may be supported on a bit of cork or wood, hollowed to its figure, and held by the pliers, instead of the charcoal fig. 2.

But if the operation is to be made in the naked fire,

Of Arrangement.

fire, the neck of the retort, fig. 9. being luted to the receiver, or balloon, fig. 20. may be hanged by a little chain with its ring over the flame, being fufpended from the piece of fig. 7. or 8. fcrewed to either of the pillars as may be moft convenient. Otherwife the receiver, fig. 20. may be fupported by the round hoop of brafs, fig. 8. or 7. fcrewed at a proper height to the pillar, fig. 1. tying round it fome packthread to defend the glafs from the contact with the metallic fupport.

The piece of fig. 6. may be fcrewed by its collar and fcrew *ef* to any of the pillars; carrying with it the retort and its receiver, at proper diftances, higher or nearer to the lamp according as the flame is more or lefs violent.

It eafily may be conceived, that thefe implements afford all forts of conveniences for making any kind of fmall operations and affays in miniature, provided the operator pays a proper attention to the difpofition requifite for each procefs or operation.

Every glafs retort, receiver, matrafs, bafon, fmall funnels, &c. are made by the lamp-workers, that blow beads, thermometers, and other fmall glafs inftruments.

It is directed that the lamp *k*, fig. 3. be filled with fpirit of wine, becaufe it gives no difagreeable fmell, and does not produce any fuliginous and difagreeable cruft on the veffels as oil does: moreover, the fpirit gives a dry flame, without fmoke, and ftronger than oil; befides the fpots and difagreeable confequences this laft caufes, if fplit, &c. M. de Morveau adds, that the expence of fpirit is quite inconfiderable; and that he performed in eight or ten minutes, with this apparatus, various diffolutions, evaporations, and other proceffes, which otherwife would have taken more than three hours, with the expence only of two or three halfpence for the fpirit of wine, whilft the fuel of charcoal would have coft near ten or eleven pence.

But a very important circumftance is, as Morveau obferves likewife, that many philofophers do not apply themfelves to chemical operations, for want of opportunity of having a laboratory to perform them: it requiring a proper room, and fuitable expences of many large furnaces, retorts, crucibles, and numerous other implements, &c. whilft thefe miniature laboratories may in great meafure afford the fame advantages; at leaft to that degree of fatisfaction fufficient to afcertain the contents and products of any fubftance that is fubjected to trial: for with this fimple apparatus a man of fome abilities may, without any embarafsment, in a very fhort time, and with little expence, perform fuch diftillations as require a reverbatory furnace; all forts of proceffes, digeftions, and evaporations, which require a regular fand heat; he may vary his experiments or trials, and multiply them to a great number of various performances, draw up his conclufions, and reafon upon them, without lofs of time, without the hinderance of long preparations to work at large. And even when fuch large works are to be performed, he may obferve beforehand various phenomena of fome fubftances, which being known in time, would otherwife impede the proceffes at large, or make them fail abfolutely; and all this without the rifk of a confiderable lofs, and without expofing himfelf to a great fire, &c.

Part II. ARRANGEMENT (A) of MINERAL BODIES (B).

THE bodies belonging to the mineral kingdom are divided into four different claffes, viz.

1. *Earths* (c), or thofe fubftances which are not ductile, are moftly indiffoluble in water or oil, and preferve their conftitution in a ftrong heat.
2. *Salts*: thefe diffolve in water, and give it a tafte; and when the quantity of water required to keep them in diffolution is evaporated, they concrete again into folid and angular bodies.
3. *Inflammables*, which can be diffolved in oils, but not in water, and are inflammable.
4. *Metals*, the heavieft of all bodies; fome of which are malleable, and fome can be decompounded.

Here, however, it muft be obferved, that thefe claffes are unavoidably blended one with another; and therefore fome exceptions muft be allowed in every one of them: for inftance, in the firft clafs, the calcareous earth is in fome meafure diffoluble in water, and pipe-clay with fome others diminifh fomewhat in their bulk when kept for a long time in a calcining heat. In the third clafs, the calx of arfenic has nearly the fame properties as falts; and there is no poffible definition of falt that can exclude the arfenic, though at the fame time it is impoffible to arrange it elfewhere than among the femimetals. In the fourth clafs it is to be obferved, that the metals and femimetals, perfect or imperfect, have not the fame qualities common to them all; becaufe fome of them may be calcined, or deprived of their phlogifton, in the fame degree of fire in which others are not in the leaft changed, unlefs particular artifices or proceffes are made ufe of: fome of them alfo may be made malleable, while others are by no means to be rendered fo. That the convex furface metals take after being melted, is a quality not particularly belonging to them, becaufe every thing that is perfectly fluid in the fire, and has no attraction to the veffel in which it is kept, or to any added matter, takes the fame figure; as we find borax, *fal fufibile microcofmicum*, and others do, when melted upon a piece of charcoal: therefore, with regard to all that has

(A) According to the fyftem of *Cronftedt* †; altered, augmented, and improved from the Obfervations of other Mineralogifts.

(B) Of the different bodies enumerated in the following claffification, full explanations are given under their refpective names as they occur in the courfe of this Work. See alfo METALLURGY, and CHEMISTRY-*Index*.

(C) By *earths*, the author (Mr Cronftedt) does not mean (ftrictly fpeaking) only earths, but includes under that title all the kinds of ftones or foffils not inflammable, faline, or metallic.

† *Cronftedt's Mineralogy*, 2d edition, in 2 vols, by Magellan.

EARTHS.

has been faid, it is hardly worth while to invent fuch definitions as fhall include feveral fpecies at once; we ought rather to be content with perfectly knowing them feparately.

CLASS I. EARTHS.

EARTHS, are thofe mineral bodies, not ductile, for the moft part not diffoluble in water or oils, and which preferve their conftitution in a ftrong heat.

Calcareous EARTHS.

Thefe bodies are here arranged according to their conftituent parts, fo far as hitherto difcovered; and are divided into five orders. See the article EARTH.

Order I. CALCAREOUS EARTHS (D).

THE properties of thefe are as follow:

1. Friability and falling into a fine white powder after calcination.

2 Partial folution in water, with which they contract

(D) Calcareous earth is moft commonly found in the form of lime-ftone; hard, compact, and of various colours; under which general name may be comprehended all the different kinds of marbles. Near Bath in England is found a kind of grey ftone, rather foft than hard. This contains calcareous earth in a mild ftate, and likewife fome in a ftate of caufticity: hence, when newly dug out of the earth, it will diffolve fulphur, or make lime-water without any calcination. By attraction of fixed air from the atmofphere, it foon hardens after it has been dug up.

Mr Williams * divides the lime-ftones of Scotland into the following fpecies:

1. Grey, whitifh, and pure white; regularly ftratified; of a granulated texture; and much ufed in the Highlands for building bridges. Some of it is compofed of fine glittering fpangles like the fcales of fifhes; and fome is as pure white as the beft refined fugar, which kind he thinks may be called *Parian marble*.

* *Nat. Hist. of the Mineral Kingdom*, 2 vols.

2. Coarfe-looking grey mountain limeftone, hard and ftrong, of a granulated texture, difficult to work in fome places rough and unequal, in others fmooth and even. Sometimes regularly ftratified, at other times appearing like one vaft irregular bed or rock, of various thickneffes.

3. Afh-coloured mountain-limeftones, confifting of fmall grains of a fine fmooth texture; when broken refembling flint. In the Highlands there are hills of this kind of ftone, which our author informs us he has feen; fome of which have regular ftrata, while others appear in one vaft mafs like a rock of granite.

4. Regularly-ftratified lime-ftone, found in the low countries, exhibiting a vaft variety of colours; as black, blue, grey, brown, purple, red, and afh-coloured, with various mixtures, of all degrees of hardnefs and purity.

5. Limeftone accompanying coal, and frequently the immediate roof of the vein. This likewife fhows a great variety of colour, texture, and quality; fome being fo much adulterated with clay and other heterogeneous mixtures as to be good for nothing, while others are very pure and fine. Thefe limeftones are always found in regular ftrata. "They are found (fays our author) as regular as the coals they accompany; and the coal-ftrata are more regular in continuation upon the bearing, as far as the clafs of ftrata belonging to the coal reaches, than any other that I have inveftigated; and I look upon it, that this obfervation may be of ufe in practice."

For difcovering limeftone at fome diftance, Mr Williams gives the following directions:—"Let them keep the line of ftretch, or bearing of the ftrata; and, in the coal-country, they will be fure to difcover it at nearly the fame parallel diftance from a feam of coal or other given ftratum, as the place where it was laft feen. But many of the mountain-limeftones are not much to be depended on. Though you may have a good and plentiful quarry in one place, yet, perhaps, half a mile, or half a quarter of a mile farther forward, you cannot difcover it: it is dwindled away to nothing, and yet will appear again farther forward; which makes the mountain-limeftones uncertain to be difcovered where you do not fee them; as thefe rocks very frequently grow thicker or thinner, and fometimes fqueezes out to nothing: and I comprehend under this denomination all the limeftones not accompanying the coals and coal-metals.—The limeftones of the coal-fields are often diftinguifhable by containing a great variety of fhells, coral, and other marine bodies, which are found blended in the heart and compofition of the ftone."

6. The Scotch marbles are of great variety and beauty; and the parts of the kingdom moft unfit for cultivation are found to abound moft in them. Affint in Sutherland has a kind of white ftatuary marble, which Mr Williams fays is the pureft and beft he ever faw. "I am perfuaded (fays he) there is none better, if any fo good, in all Europe, and there is enough of it to ferve all Britain; perfectly folid and pure, free of any blemifhes, flaws, or ftains, and blocks or flabs of any fize may be cut out: but there is bad accefs to it; nor would it be eafily quarried, there being a little cover above it, of a foft, loofe, whitifh limeftone. This marble accompanies a prodigious rock of grey limeftone, of a granulated texture, appearing in regular ftrata at Affint; but it is one of thofe which varies in thicknefs as you advance along the bearing of the ftrata. The good white marble of Affint is only to be feen in the bed of the river, near a confiderable houfe a mile or two fouth of the church; but I cannot remember the name of the particular place."

Near Blairgourie in Perthfhire, not far from the fide of the high road, is an excellent, granulated, broad-bedded limeftone, of a fugar-loaf texture, and as white as the fineft ftatuary marble, which Mr Williams fuppofes to be a good fpecies of the true Parian marble, and that it requires only to be known and brought into ufe to become of great value. In the duke of Gordon's lands, in the foreft of Glenavon, there is alfo a kind of marble compofed of broad glittering grains like fpangles, as large as the fcales of fifhes; but the fituation is remote, and difficult of accefs.

In

tract great heat, and by sprinkling with water they fall more readily into powder.

3. Infusibility without addition.

4. They attract the fixed air from the vegetable and mineral alkalies, and thus rendering them much more caustic, becoming at the same time mild themselves.

5. Solubility in all acids except the vitriolic, tartarous, and some anomalous vegetable acids.

6. Fusibility with borax and microcosmic salts.—The fusion is attended with effervescence, and the result is a transparent and colourless glass.

7. With metalline calces they melt into a corrosive slag.

8. They imperfectly reduce the calces of lead and bismuth, and have even some effect upon those of copper and iron.

The calcareous earth is found,

I. Pure.

1. In form of powder. *Agaricus mineralis*, or *lac lunæ*.
   a. White, in moors, and at the bottom of lakes.
   b. Red.
   c. Yellow.

2. Friable and compact. Chalk, *creta*.
   a. White, *creta alba*. Chalk is a nam aelso applied to other earths; whence we hear of chalks of various colours: but there are none which are known to be of a calcareous nature, except this kind here described, and of which there are no other varieties, otherwise than in regard to the looseness of the texture, or the fineness of the particles.

3. Indurated, or hard; Limestone; *Lapis calcareous*.
   A. Solid, or not granulated.
   a. White.
   b. Whitish yellow.
   c. Flesh-coloured, found in loose masses.
   d. Reddish brown.
   e. Grey.
   f. Variegated with many colours, and particularly called *marble*.
   g. Black.

   B. Grained or granulated limestone.
   1. Coarse-grained, and of a loose texture, called *salt-slag* in Swedish, from its resemblance to lumps of salt.
      a Reddish yellow. b. White.
   2. Fine-grained.
      a. White. b. Semi-transparent, from Solfatara in Italy, in which native brimstone is found.
   3. Very fine grained.
      a. White and green. b. White and black.

   C. Scaly limestone.
   1. With coarse or large scales.
      a. White. b. Reddish yellow.
   2. With small scales.
      a. White.
   3. Fine glittering or sparkling.
      a. White. b. Of many colours.

   D. Lime or calcareous spars.
   (1.) Of a rhomboidal figure.
   A. Transparent or diaphanous.
   1. Refracting spar; *Spatum islandicum*; Iceland spar, or Iceland crystal.—This represents the objects seen through it double,
   2. Common spar, which shows the object single.
      a. White, or colourless.
      b. Yellowish and phosphorescent.
   B. Opaque.
   1. White. 2. Black. 3. Brownish yellow.
   (2.) Foliated or plated spar.
      a. Opaque white.

   E. Crystallized calcareous spars. *Spar. Drusen* (E.)
   (1.) Transparent.
      a. Hexagonal truncated.
      b. Pyramidal.
   1. Dog's teeth; *Pyramidales distinctæ*.
   2. Balls of crystallized spar, *Pyramidales concretæ*.

   F. Stalactitical spar; *Stalactites calcareus*. Stalactites, Stone-icicle, or Drop-stone.
   (1.) Scaled stalactites of very fine particles.
      a. Of a globular form.
   1. White, the pea-stone.
   2. Grey, *pisolithus*, *oolithus*. Also the hammites, from its resemblance to the roes or spawn of fish. It has been exhibited by authors as petrified roes. The Ketton free-stone, of Rutlandshire, is a remarkable stone of this sort.
      b. Hollow, in the form of a cone.
   1. White.
      c. Of an indeterminate figure.
      d. Of coherent hollow cones.
   (2.) Solid stalactites of a sparry texture.
      a. Hollow, and in form of a cone.
   1. White, and semitransparent.

II. Sa-

In Lochaber, near the farm-houses on the north side of the ferry of Ballachylish, is a limestone or marble rock, of a beautiful ashen-grey colour, and a fine regular uniform grain or texture; capable of being raised in blocks or slabs of any size, and of receiving a fine polish. It is beautifully sprinkled with fine bright grains of mundick or pyrites, and likewise with grains or specks of beautiful lead ore of a fine texture.

About three miles south of Fort-William, in the bed of a river, is a curious kind of marble with a black ground, flowered with white, like fine needle-work, or rather resembling the frost flowering upon glass windows in winter; and this flowering is not only on the outside, but quite through all parts of the body of the stone.

Scotland has also chalk in abundace; some of which is regularly stratified, and much appears in thick irregular masses like sediment.

(E) The translator of Mr Cronstedt's Treatise has adopted this German term *drusen* into the English language, for a cluster of regular figured bodies, as a groupe conveys the idea of a cluster only, whether regular or of indeterminate figures.

Calcareous Earths.

II. Saturated or combined with the acid of vitriol. Gypfum, Plafter-ftone, or Parget.

1. Loofer and more friable than a pure calcareou earth.
2. Either crude or burnt, it does not excite any effervefcence with acids; or, at moft, it effervefces but in a very flight degree, and then only in proportion as it wants fome of the vitriolic acid to complete the faturation.
3. It readily falls into a powder in the fire.
4. If burnt, without being red-hot, its powder readily concretes with water into a mafs, which foon hardens; and then,
5. No heat is perceived in the operation.
6. It is nearly as difficult to be melted by itfelf as the limeftone, and fhows moftly the fame effects with other bodies as the lime-ftone: the acid of vitriol feems, however, to promote its vitrification.
7. When melted in the fire with borax, it puffs and bubbles very much, and for a long while, during the fufion, owing to the nature of both the falts.
8. When a fmall quantity of any gypfum is melted together with borax, the glafs becomes colourlefs and tranfparent; but fome forts of alabafter and fparry gypfa, when melted in fome quantity with borax, yield a fine tranfparent yellow coloured glafs, refembling that of the beft topazes. This phenomenon might probably happen with every one of the gypfeous kind. But it is to be obferved, that if too much of fuch gypfum is ufed in proportion to the borax, the glafs becomes opaque, juft as it happens with the pure limeftone.
9. Burnt with any inflammable matter, it emits a fulphureous fmell; and may as well by that means, as by both the alkaline falts, be decompounded; but for this purpofe there ought to be five or fix times as much weight of falt as of gypfum.
10. Being thus decompounded, the calx or earth which is left fhews commonly fome marks of iron.

The gypfeous earth is found,

(1.) Loofe and friable. Gypfeous earth, properly fo called; *Guhr*.
 A. White.

(2.) Indurated.
 A. Solid, or of no vifible particles, Alabafter.
  a. White, alabafter.
   1. Clear and tranfparent.
   2. Opaque.
  b. Yellow.
   1. Tranfparent, from the Eaftern countries.
   2. Opaque.
 B. Gypfum of a fcaled or granulated ftructure. This is the common plafter-ftone.
  1. With coarfe fcales. *a*. White.
  2. With fmall fcales. *a*. Yellowifh. *b*. Greyifh.
 C. Fibrous gypfum, or plafter-ftone, improperly (though commonly) called *Englifh talc* by our druggifts.
  1. With the fibres coarfe. *a*. White, from Livonia.
  2. With fine fibres. *a*. White.
 D. Spar-like gypfum. Selenites, by fome alfo called *glacies mariæ*; and confounded with the clear and tranfparent mica.
  1. Pure felenites.
   A. Tranfparent.
    a. Colourlefs. *b*. Yellowifh.
  2. Liverftone, fo called by the Swedes and Germans.
 E. Cryftallifed gypfum. Gypfeous drufen.
  (1.) Drufen of cryftals of pure fparry gypfum.
   A. Wedge-formed, compofed of a pure fpar-like gypfum.
    a. Clear and colourlefs. *b*. Whitifh yellow.
   B. Capillary.
    a. Opaque, whitifh yellow. *b*. Hexagonal, prifmatic. *c*. Globular, confifting of cuneated rays proceeding from the centre.
 F. Stalactitical gypfum. *Gipfum finter*.
  1. Of no vifible particles; in French, *grignard*.
   A. Of an irregular figure.
    a. Yellow. *b*. White.
  2. Of a fpar-like texture.
   A. In form of a cone.
    a. White and yellow.
   B. Of an irregular figure.
    a. White.

III. Calcareous earth faturated with the acid of common falt. *Sal ammoniacum fixum naturale*.
This is found, 1. In fea-water. 2. In falt-pits.

IV. Calcareous earth combined or faturated with fparry acid, known by the name of *fparry fluor* and *blue john*.

Thefe are commonly called *fluxing*, *vitrefcent*, or *glafs*-fpars; becaufe moft part of them have a fparry form and appearance: they are, however, often met in an indeterminate figure.

They are only known in an indurated ftate, and diftinguifh themfelves from the other earths by the following characters.

1. They are fcarce harder than common calcareous fpars, and confequently do not ftrike fire with fteel.
2. They do not ferment with acids neither before nor after calcination.
3. They do not melt by themfelves; but crack and fplit to pieces when expofed to a ftrong fire. But,
4. In mixtures with all other earths they are (generally) very fufible, and efpecially with calcareous earth, with which they melt into a corroding glafs that diffolves the ftrongeft crucibles, unlefs fome quartz or apyrous clay be added thereto.
5. When heated flowly, and by degrees, they give a phofphorefcent light: but as foon as they are made red-hot, they loofe this quality. The coloured ones, efpecially the green, give the ftrongeft light, but none of them any longer than whilft they are well warm.
6. They melt and diffolve very eafily by the addition of borax; and, next to that, by the microcofmic falt, without ebullition.

A. Indurated fluor.

(1.) Solid, of an indeterminate figure; of a dulll texture, femitranfparent, and full of cracks in the rock.

a. White.

(2.) Sparry fluor. This has nearly the figure of fpar; though on clofe obfervation it is found not to be fo regular, nothing but the gloffy furfaces of this ftone giving it the refemblance of fpar.

a. White. *b.* Blue. *c.* Violet. *d.* Deep green. *e.* Pale green. *f.* Yellow.

(3.) Cryftallifed fluor.

1. Of an irregular figure. *a.* White. *b.* Blue. *c.* Red.
2. Of a cubical figure. *a.* Yellow. *b.* Violet.
3. Of a polygonal fpherical figure. *a.* White. *b.* Blue.
4. Of an octoedral figure. *a.* Clear, colourlefs.

V. Calcareous earth faturated with a particular acid, perhaps of the metallic kind, *viz.* the tungftenic acid. The *tungftein* of the Swedes.

This refembles the garnet-ftone and the tin-grains; is nearly as heavy as pure tin; very refractory in the are, and exceffively difficult to reduce to metal. Iron has, however, been melted out of it to more than 30 *per cent.* It is very difficultly diffolved by borax and alkaline falts, bet melts very eafily with the microcofmic falt, giving a black flag; and for this reafon the laft mentioned falt muft be employed in the affays of this ftone. It is found,

1. Solid and fine-grained.
a. Reddifh or flefh-coloured. *b.* Yellow.
2. Spathofe, and with an unctuous furface.
a. White. *b.* Pearl-coloured.

VI. Calcareous earth united with the inflammable fubftance.

Thefe have a very offenfive fmell, at leaft when rubbed. They receive their colour from the phlogifton, being dark or black in proportion as it predominates.

(1.) Calcareous earth mixed with phlogifton alone; *Lapis fuillus*, fetid ftone and fpar, or fwine-ftone and fpar.

A. Solid, or of no vifible or diftinct particles.
a. Black.
B. Grained.
a. Blackifh brown.
C. Scaly, *particulis micaceis.*
1. With coarfe fcales, *a.* Black.
2. With fine fparkling fcales. *a.* Brown.
D. Sparry.
a. Black. *b.* Light brown. *c.* Whitifh yellow.
E. Cryftallifed.
1. In a globular form.

VII. Calcareous earths blended with an argillaceous earth. Marle, *Marga.*

1. When crude, it makes an effervefcence with acids: but,
2. Not after having been burnt; by which operation it is obferved to harden, in proportion as the clay exceeds the calcareous fubftance.
3. It eafily melts by itfelf into a glafs, and even when it is mixed with the moft refractory clay.
4. It is of great ufe in promoting the growth of vegetables, fince the clay tempers the drying quality of the calcareous earth.

5. When burnt in a calcining heat, it readily attracts water: and, expofed to the air, in time it falls into a powder.

The varieties of this kind worthy to be taken notice of, depend on the different quantities of each of their component parts, and on the quality of the clay. The following are fpecified as examples.

A. Loofe and compact, *Marga friabilis.*
a. Reddifh brown.
b. Pale red. This, when burnt, is of a yellowifh colour, and ufed for making earthen ware in fome places.
B. Semi-indurated; which is nearly as hard as ftone when firft dug up, but moulders in the open air.
a. Grey. *b.* Red.
C. Indurated, or ftone marle.
A. in loofe pieces, *Marga indurata amorpha;* by the Germans called *duckftein* or *tophftein.*
a. White. *b.* Grey, formed from a fediment which the water carries along with it.
B. In continued ftrata. Hard flaty marle.

VIII. Calcareous earth united with a metallic calx.

Here, as well as in the others, fuch a mixture or combination is to be underftood, as cannot be difcovered by the eye alone without the help of fome other means.

The fubjects belonging to this divifion lofe the property of raifing an effervefcence with acids, when they are rich in metal, or contain any vitriolic acid. However, there have been found fome that contained 20 or 30 *per cent.* of metal, and yet have fhown their calcareous nature by the nitrous acid.

There are no more than three metals hitherto known to be united in this manner with the calcareous earth, *viz.*

(1.) With iron. White fpar like iron ore, *Minera ferri alba.* The *ftahlftein* or *weifes eifenerz* of the Germans.

1. This ore, however, is not always white, but commonly gives a white powder when rubbed.
2. It becomes black in the open air, as likewife in a calcining heat.
3. In this laft circumftance it lofes 30 or 40 *per cent.* of its weight, which by diftillation has been found owing to the water that evaporates; and it is poffible that fome fmall quantity of vitriolic acid may, at the fame time, evaporate with the water.
4. It is of all the iron ores the moft eafy to melt, and is very corrofive when melted.

This kind is found,

A. Loofe; the mouldered part of the indurated fort.
a. Black, like foot.
b. Dark brown, fomewhat refembling umbre.
B. Indurated.
1. Solid, of no diftinct particles.
a. Red. Looks like red ochre, or the red hæmatites, but diffolves in the acid of nitre with a great effervefcence.
2. Scaly, *particulis micaceis.*
a. White.
b. Blackifh grey.
3. Spar-like.
a. Light brown.

4. Drufen.

4. Drusen.
a. Blackish brown.
b. White.
1. Porous. This is often called *eisen-blute*, or *flos ferri*.
2. Cellular.

(2.) With copper.
A. Loose and friable. Mountain blue; Germanicè, *Bergblau*. This dissolves in aquafortis with effervescence.
B. Indurated.
1. Pure calcareous earth mixed with calx of copper. Armenian stone, *lapis Armenus*.
2. Gypseous earth united with calx of copper. Is of a green colour; and might perhaps be called *turquoise ore*, or *malachites*; though we do not know if all sorts of turquoise ore are of this nature.
a. Semi-transparent, is found at Ardal in Norway.

(3.) With the calx of lead.
This is a lead ochre, or a spar-like lead-ore, which, in its formation, has been mixed with a calcareous earth, and for that reason effervesces with acids.
A. Loose and friable.
1. White.
B. Indurated.
1. Scaly.
a. Yellowish.
Both these varieties contain a considerable quantity of lead, *viz.* 40 *per cent.* more or less; and the calcareous earth is as equally and intimately mixed with it, as in the white iron ore.

IX. The following compounds of calcareous earth with different mineral substances are added from Mr Kirwan's Elements of Mineralogy.

1. A compound of calcareous and barotical earths: of this species are some yellowish stones found in Derbyshire, consisting of lumps of limestone interspersed with nodules of baroselenite. Many more may occur as compounds of gypsum and baroselenite, fluor and baroselenite, &c. &c.
2. Compounds of calcareous and magnesian earths; such as,
a. The white marble, interspersed with spots of steatites or soap-rock, either green or black, called by Cronstedt *kolmord marble*. This marble is of a scaly texture.
b. The *pietra talchina* of the Italians, which consists of white spar with veins of talc.
c. The *verde antico* of the Italians, which is a light green marble, with deep green, black, white, and purple spots. According to Mr Bayen, it contains 62 parts of mild calcareous earth, 30 of green talc, 1 of magnesia, and 1 of semiphlogisticated iron.
3. Compounds of calcareous and argillaceous earths; such as,
a. The green Campan marble from the Pyrenées. It is slaty and somewhat magnetic. According to Mr Bayen, it contains 65 of mild calcareous earth, 32 of the argillaceous, and 3 of semiphlogisticated iron.
b. The red Campan marble: this is not magnetic; it contains 82 parts of mild calcareous earth, 11 of argillaceous shistus, and 7 of dephlogisticated iron.
c. Yellow figured marble from Florence: according to Mr Bayen, it contains 75 parts of mild calcareous earth, 13 or 14 of shistus, and 4 or 5 of dephlogisticated iron.
d. Griotte marble from Autun of Burgundy in France: it contains 67 parts of mild calcareous earth, 26 of reddish schistus, 2 of iron, and 1 of magnesian earth.
e. The Amandola, which is a green marble, honey-comb like, with white spots. It contains 76 parts of mild calcareous earth, 20 of schistus, and 2 of semiphlogisticated iron. The cellular appearance proceeds from the schistus.
4. Compounds of calcareous earth and mica; such as,
a. The cipolin from Autun in France: it is of a green colour, and consists of 83 parts of chalk, 12 of green mica, and 1 of iron.
b. The micaceous limestone, is of a glittering appearance, of various degrees of hardness, and effervesces with acids. Such as the macigno of the Italians; their yellow pietra bigia; and their blue pietra columbina or turkina.
5. Compounds of calcareous and siliceous earths; such as,
a. The calcareous quartz and pudding-stone: this consists of lumps of quartz, and sometimes of felt-spar in a calcareous cement.
b. The limestone with veins of quarts; such as the *saxum sahlbergense*, and several marbles of Sweden and Siberia, which strike fire with steel.
6. Calcareous volcanic pudding-stone; such as,
a. The cierchina, which consists of lumps of spar and lava in a calcareous cement, mentioned by Mr Ferber.
b. The marble mixed with veins of black or green lava, mentioned by the same anthor.
7. Compounds of calcareous earth, mixed with two or more kinds of earth; such as,
a. The cipolin from Rome, which is a green marble with white zones: it strikes, though difficultly, fire with steel: it contains 67,8 parts of mild chalk, 25 of quartz, 8 of shistus, and 0,2 of iron, besides the iron contained in the argillaceous shistus.
b. The calcareous porphyry, which consists of quartz, felt-spar, and mica in separate grains united by a calcareous cement.
c. The limestone interspersed with shoerl and mica.
d. To these compounds belongs the pyritaceous limestone called by the French *Pierre de St Ambroix*. It is of an iron grey colour, interspersed with shining particles. Its texture is compact, and scarcely gives fire with steel. Its specific gravity is 2,7034. It is soluble in acids, and mostly with effervescence; calcines in a strong fire; makes nitre slightly detonate; and if distilled affords a small portion of vitriolic acid, and some sulphur sublimes. Its component

ponent parts are 75 of mild calcareous earth and 25 of pyrites; in which are contained 14 of argill, 7 of quartz and fulphur, and 4 of iron.

Order II. Ponderous Earth.

Ponderous earth, (*Terra Ponderofa*): Cauk, or calk. See Earth, Art. I. This is a particular kind of earth (like chalk in appearance, but with fome very different properties), difcovered in Sweden about 1774, which by its refults with other bodies has fome fimilarity to the known alkalis. It has not yet been found pure, but mixed with other fubftances: however, its great fpecific weight eafily diftinguifhes it from the others, it being the heavieft of all earths.

1. Its fpecific gravity when confiderably purified by art is 3,773.
2. This earth combines with aerial acid: and in this cafe effervefces with ftronger acids.
3. With vitriolic acid it forms the ponderous fpar, which is infoluble in water.
4. Its cryftallization, after being combined with the nitrous, or with the muriatic acids, is hardly foluble;
5. But with acetous acid, it becomes deliquefcent.
6. When pure; viz. without any mixture of acid or alkali, it does not vitrify in the fire.
7. If deprived of the aerial acid (fixed air) by calcination, is then foluble in 900 times its weight of boiling water. This folution expofed to air, forms a cremor, like that of lime-water in the fame circumftances, and like it changes alfo the vegetable colours.
8. Whilft combined with aerial acid, it is only foluble in about 1550 times its weight of water, chiefly if the water has been impregnated alfo with the fame aerial acid.
9. It expels the cauftic volatile alkali from ammoniacal falt.
10. Mixed with brimftone it produces a hepar fulphuris, whofe folution in water is but incompletely decompofed either by the nitrous or the muriatic acid, on account of the great attraction between this earth and the acid of fulphur, which is fo ftrong that it
11. Separates this acid (the vitriolic) from the vegetable alkali.

I. Combined with aerial acid; *Terra ponderofa aërata*. See Chemistry-*Index*.
 It refembles alum, but is hard and ftriated, as if compofed of radiating fibres coming from a centre. It is found in Alfton-moor in England.
 A. Spar-like gypfum.
 1. Semitranfparent, *fpatum Bononienfe*. The Bononian ftone, or native phofphorus.
 2. Opaque. *a.* White. *b.* Reddifh.
 B. Ponderous Drufen fpar.
 1. Jagged, *criftatum*. Thefe refemble cock's combs, and are found in clefts and fiffures accreted on the furfaces of balls of the fame fubftance.
 2. White.
 3. Reddifh.

II. United with phlogifton and the vitriolic acid. *Leberftein* of the Germans and Swedes. *Lapis hepaticus*.
 This ftone in fome fpecimens conftantly, but in others only when rubbed, fmells like the *hepar fulphuris*, or gun-powder.
 It is found,
 A. Scaly.
 1. With coarfe fcales. *a.* Whitifh yellow.
 2. With fine fparkling fcales. *a.* Black.

Order III. Magnesian, Micaceous, and Asbestine Earths.

§ 1. *Magnefian Earths.*

Magnesia is a white, loofe, and light earth, only known fince the beginning of this century. It is generally found combined or mixed with other heterogeneous fubftances, as other fimple earths are.

1. When pure its fpecific gravity is 2,330, and then
2. It neither hardens, contracts, nor melts by the application of heat, even by the folar rays.
3. But it melts eafily with borax, or microcofmic falt; though it is fcarcely affected by fixed alkalis or calces of lead.
4. Mixed with other earths, it produces by fire different hard maffes.
5. It gives no caufticity except to the volatile alkali: and
6. Does not effervefce with any acid.
7. When mixed with water it fhows a very fmall degree of heat, but without any effervefcence. And when the water exceeds the weight of magnefia about 7,692 times, it is totally diffolved.

8 and 9. Being put in water and afterwards dried, it contains $\frac{18}{100}$ parts of its weight; though when faturated with aerial acid, it will abforb and retain after being dried $\frac{66}{100}$ parts of water.

10. This earth combined with aerial acid is more foluble in cold than in hot water.
11. Combined with vitriolic acid it cryftallizes into a bitter falt, known by the name of *Epfom* and *Seydlitz* or *Seidfchulitz* falt, which is foluble in little more than its own weight of water.
12. With nitrous acid it forms a deliquefcent falt.
13. With the muriatic or the acetous acids it does not cryftallize: and the mafs being dried, attracts humidity from the air.
14. It has a ftronger attraction to the fluor acid than to any other (Berg.): and cryftallizes with it into hexangular prifms whofe ends are formed of two low pyramids, of three rhombs (*Romé de l'Ifle*).
15. It is not precipitated from other acids by the vitriolic, as calcareous earth is.
16. According to Lavoifier and Macquer, when magnefia is calcined, it becomes phofphorefcent.

I. Magnefia combined with vitriolic and other acids.
 A. When faturated with the vitriolic acid, it forms a bitter falt, called *Englifh* or *Epfom*, *Seydfhutz* or *Sedlitz* falt. The falts known under thefe different

Magnesian Earths.

ferent names only differ from one another on account of some heterogeneous substance, which is combined in them, the vitriolated magnesia being the characteristic and principal ingredient in them all.

B. Magnesia is found not only combined with the vitriolic acid in the waters of Epsom, Sedlitz, &c. but also with the marine acid to a considerable quantity in sea-water and other salt springs.

C. It is contained frequently in fresh waters, where it is dissolved by means of a quantity of aerial acid.

II. Combined with other earths.

A. Magnesia, when combined with siliceous earth, is commonly unctuous to the touch, and more or less difficult to be cut or turned in proportion to its different degrees of hardness.

It is not diffusible in water: grows hard, and is very refractory in the fire.

When pounded and mixed with water, it will not easily cohere into a paste: however, if it is managed with care, it may be baked in the fire to a mass, which being broken, shows a dull and porous texture.

It takes for the most part, and without much labour, a fine polish. It is found,

(1.) Compact and soft; *Smectis*, *Briançon* or French chalk.
- *a.* White, from the Lands-End, in Cornwall.
- *b.* Yellow.
- *c.* Red and white, from the Lands-End: the soap-earth, from Switzerland: it looks like Castile-soap.

(2.) Solid and compact; of impalpable particles: Steatites or soap-rock.
- *a.* White, or light green. *b.* Deep green.— *c.* Yellow.

(3.) Solid, and of visible particles; serpentine stone.

A. Of fibrous and coherent particles.

This is composed, as it were, of fibres, and might therefore be confounded with the asbestus, if its fibres did not cohere so closely with one another, as not to be seen when the stone is cut and polished. The fibres themselves are large, and seem as if they were twisted.
- *a.* Deep green. It is sold for the *lapis nephriticus*, and is dug at some unknown place in Germany. *b.* Light green, from Skienshyttan, in Westmanland; is used by the plate-smiths instead of French chalk.

B. Of granulated particles; fine grained sepentine stone, the Zoeblitz serpentine.
- *a.* Black. *b.* Deep green. *c.* Light green. *d.* Red. *e.* Bluish grey. *f.* White. These colours are all mixed together in the serpentine stone from Zoeblitz, but the green is the most predominant colour.

B. Porcelain earth mixed with iron; *terra porcellanea* This is,

A. Diffusible in water.
- *a.* Red, from Montmartre, and China. The water-clinkers which are imported from certain places in Germany seem to be made of this kind.

B. Indurated.

1. Martial soap earth.
   - *a.* Red.
2. Martial soap rock.
   - *a.* Black.
   - *b.* Red.

C. The telgsten of the Swedes; *lapis ollaris*.
- *a.* Light grey. *b.* Whitish yellow. *c.* Dark grey. *d.* Dark green.

The serpentine stone has many varieties; being found, (1.) Veined or spotted with green steatites. (2.) Red, with veins of asbestos. (3.) Red, green, yellow, or black with veins or spots of white calcareous spar, is called *potzevera*. The black is called *nero di prato;* the green *verde di Suza;* but these names are not restrained to this species. (4.) Veined or spotted with gypsum. (5.) Veined or spotted with baroselenite. (6.) Veined or spotted with shiftus.— And, (7.) With veins of quartz, feltspar, or shoerl. (*Kirwan's Mineralogy.*)

What is commonly called *serpentine* is a true *lapis ollaris;* but being variegated with green, yellowish, and brown spots, like the skin of some common serpents, it is called by that name. Great quantities of this stone are found in Italy and Switzerland, where it is often worked into the shape of dishes and other vases. (*Fabroni.*) And the *gabro* of the Italians is nothing else but a kind of serpentine, (*Kirwan.*)

§ 2. *Micaceous Earths.*

These are known by the following characters:

1. Their texture and composition consist of thin flexible particles, divisible into plates or leaves, having a shining surface.
2. These leaves or scales exposed to the fire lose their flexibility and become brittle, and then separate into inner leaves: but in a quick and strong fire, they curl or crumple, which is a step towards fusion; though it is very difficult to reduce them into pure glass by themselves or without addition.
3. They melt pretty easily with borax, the microcosmic salt, and the alkaline salt: and may by means of the blow-pipe be brought to a clear glass with the two former salts. The martial mica is, however, more fusible than the uncoloured ones: its specific gravity is 3,000.

A. Colourless or pure mica; daze, glimmer, or glist.
1. Of large parallel plates; Muscovy glass. This is transparent as glass; found in Siberia and Elfdalen in the province of Wermeland.
2. Of small plates, from Silfverberget, at Runneby, in the province of Blekinge.
3. Of fine particles like chaff; chaffy mica.
4. Of twisted plates; crumpled mica.

B. Coloured and martial glimmer.
1. Brown, semi-transparent.
2. Of fine and minute scales.
   - *a.* Brown. *b.* Deep green. *c.* Light green. *d.* Black.
3. Twisted or crumpled glimmer.
   - *a.* Light green.
4. Chaffy glimmer.
   - *a.* Black.

5. Chryſtallized glimmer.
   a. Of concentrated and erect ſcales.
   b. Of hexagonal horizontal plates.

The tranſparent Muſcovy glaſs is uſed for windows, and upon all occaſions where panes of glaſs are wanted. Perhaps it might alſo be advantageouſly employed to cover houſes.

The twiſted or crumpled mica, which is found at Hardol in Jemtland, is there manufactured into kettles and other veſſels, as alſo for hearths of chimnies: and the powder which falls in the working may be mixed with the common ſalt for the diſtillation of the muriatic acid.

§ 3. *Aſbeſtine Earths.*

Theſe are only yet diſcovered in an indurated ſtate; and their characters are as follows:

1. When pure, they are very refractory in the fire.
2. In large pieces they are flexible.
3. They have dull or uneven ſurfaces.
4. In the fire they become more brittle.
5. They do not ſtrike fire with the ſteel.
6. They are not attacked by acids.
7. They are eaſily brought into fuſion by borax or alkali.

In this ſection are included both thoſe varieties which by foſſilogiſts have been mentioned under the names of *amiantus* and *aſbeſtus*, and have often been confounded together.

I. Aſbeſtus, which is compounded of ſoft and thin membranes; *amiantus Wallerii.*
   A. Of parallel membranes: *Corium, ſive caro montana;* Mountain-leather.
      1. Pure. a. White.
      2. Martial. a. Yellowiſh brown.
   B. Of twiſted ſoft membranes; mountain-cork.
      1. Pure. a. White.
      2. Martial. a. Yellowiſh brown.

II. Of fine and flexible fibres: Earth-flax; *aſbeſtus Wallerii.*
   A. With parallel fibres: *Byſſus.*
      1. Pure and ſoft. a. Light green. b. White.
      2. A little martial, and more brittle.
         a. Greeniſh, from Baſtnas Grufva, at Ryddarhyttan in Weſtmanland. There it forms the greateſt part of the vein out of which the copper ore is dug; a great part of it is conſequently melted together with the ore, and is then brought to a pure ſemi-tranſparent martial ſlag or glaſs.
   B. Of broken and recombined fibres.
      1. Martial. a. Light green.

Order IV. Siliceous Earths.

Siliceous earth is, of all others, the moſt difficult to deſcribe and to diſtinguiſh perfectly; however, it may be known by the following characters, which are common to all bodies belonging to this order.

1. In its indurated ſtate it is hard, if not in regard to the whole, yet at leaſt in regard to each particle of it, in a degree ſufficient to ſtrike fire with ſteel, and to ſcratch it, when rubbed againſt it, though the ſteel be ever ſo well tempered.
2. When pure, and free from heterogeneous particles, it does not melt by itſelf, neither in a reverbatory nor in a blaſt furnace.
3. After being burnt, it does not fall to a powder, neither in the open air nor in water, as the calcareous earth does, but becomes only a little looſer and more cracked by the fire, unleſs it has been very ſlowly, and by degrees, heated.
4. It excites no efferveſcence with acids.
5. In the fire it melts eaſieſt of all to a glaſs with the fixed alkaline ſalt; and hence it has got the name of vitreſcent, though this name is, properly ſpeaking, leſs applicable to this order than to a great many other earths.

To the above we may add the following properties, from Bergman.

6. It is not ſoluble in any of the known acids, the fluor-acid only excepted. But,
7. It may be diſſolved by the fixed alkali, both in the dry and wet way.
8. If the fixed alkali is only half the weight of the ſiliceous earth, it produces a diaphonous and hard glaſs: but when it is in a double or triple proportion, then the glaſs deliqueſces of itſelf by attracting the humidity of the atmoſphere.
9. It melts eaſily with borax; but
10. With microſcomic ſalt it is more difficult, and requires a longer time to melt.
11. This earth has a great analogy to acids, as it is perfectly diſſolved in that wonderful natural hot-water-ſpout above ninety feet high at Geyſer, in Iceland, where by cooling it forms a ſiliceous maſs.

§ 1. *Gems, or precious ſtones.*

I. Diamond. *Adamas gemma.* See Diamond.
   1. Of all ſtones, it is the hardeſt.
   2. Is commonly clear, or tranſparent; which quality, however, may, perhaps, only belong to its cryſtals, but not to the rock itſelf from which they have their origin.
   3. Its ſpecific gravity is neareſt 3,500. When brought to Europe in its rough ſtate, it is in the form either of round pebbles with ſhining ſurfaces, or of cryſtals of an octoedral form.
   a. Colourleſs, or diaphonous, or the *diamond* properly ſo called.
      But it alſo retains this name when it is tinged ſomewhat red or yellow. Being rubbed, it diſcovers ſome electrical qualities, and attracts the maſtic.
   b. Red; Ruby. *Adamas ruber; Rubinus.*— Which, by lapidaries and jewellers, is, in regard to the colour, divided into,
      1. The ruby of a deep red colour inclining a little to purple.
      2. Spinell, of a dark colour.
      3. The balaſs, pale red, inclining to violet. This is ſuppoſed to be the mother of the rubies.
      4. The rubicell, reddiſh yellow.
      However, all authors do not agree in the characters of theſe ſtones.

II. Sapphire. *Sapphyrus gemma.*
   It is tranſparent, of a blue colour; and is ſaid to be in hardneſs next to the ruby, or diamond.

III. To-

Siliceous Earths, Gems.

III. Topaz. *Topazius gemma.*

a. The pale yellow topaz; which is nearly uncoloured.

b. The yellow topaz.

c. Deep yellow, or gold coloured topaz, or oriental topaz.

d. Orange-coloured topaz.

e. The yellowish green topaz, or *chrysolite.*

f. The yellowish green, and cloudy topaz, the *chrysoprase* (A).

g. Bluish green topaz, or the beryl.

This varies in its colours; and is called, when

1. Of a sea-green colour, the *aqua-marine.*

2. When more green, the *beryl.*

IV. Emerald. *Smaragdus gemma.*

Its chief colour is green and transparent. It is the softest of precious stones, and when heated it is phosphorescent like the fluors.

V. To the precious stones belong also the jacinths, or hyacinths; which are crystals harder than quartz crystals, transparent, of a fine reddish-yellow colour when in their full lustre, and formed in prisms pointed at both ends: these points are always regular, in regard to the number of the facets, being four on each point; but the facets seldom tally: the sides also which form the main body, or column, are very uncertain in regard both to their number and shape; for they are found of four, five, six, seven, and sometimes of eight, sides: further, the column or prism is in some also so compressed, as almost to resemble the face of a spherical facetted garnet.

Mr Cronstedt says, he got some jacinths of a quadrangular figure, which did not melt in the fire, but only became colourless.

VI. The amethyst is a gem of a violet colour, with great brilliancy, and as hard as the best kind of rubies or sapphires, from which it only differs by its colour. This is called the *oriental amethyst;* and is very rare: when it inclines to the purple, or rosy colour, it is more esteemed than when it is nearer to the blue.

These amethysts have the same figure, hardness, specific gravity, and other qualities, as the best sapphires or rubies; and come from the same places, particularly from Persia, Arabia, Armenia, and the West Indies.

The amethysts called *occidental,* are of the same nature as rock crystals, and have the same gradations, viz. of a violet inclining to the purple

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(A) In the *Annals of Chemistry,* Vol. I. we have the following account of the method of digging for the chrysoprasus, and of the earths and stones with which it is accompanied.

This precious stone is found in certain mountains in Silesia, which seem to begin those of Tradas, extending to within half a league of Glatz. These mountains appear, in general, to consist of a number of strata, horizontal or inclined, composed chiefly of substances containing magnesia, but likewise mixed with calcareous, argillaceous, and siliceous earths. The greatest part of these consist of serpentine, mixed with asbestos and amianthus, grey argillaceous earths, boles, and red or green ochres, stone marrow, steatites, or soapstone, and talc. In those mountains also we meet with quartz, petrosilex, opal, and chalcedony, in detached fragments, and sometimes in continued veins. We also discover in them veins of sand, of the nature of granite. Sometimes the serpentine is met with at the surface; sometimes at the depth of 20 or 30 feet. The stone marrow seems here to be produced by the decomposition of a very milky species of opal agate named *cacholong;* for at the depth of 50 feet and upwards the veins of this soapy earth assume a degree of solidity, and we find nothing but hard and semitransparent cacholongs.

The above-mentioned strata are crossed by a great number of cracks filled with green-coloured earths and stones; but these frequently do not contain a single true chrysoprasus. They are sometimes found immediately under the vegetable mould, or at the depth of some feet, in shapeless masses, covered with a heavy clay, and sometimes enveloped by an unctuous earth of a beautiful green colour, which it derives from the calx of nickel. In other places, the chrysoprasus has been found in uneven laminæ of several yards in length and breadth, either immediately under the mould, or in the upper strata of serpentine, which have little solidity; and very beautiful ones have been found at the depth of seven or eight fathoms; and some have been met with in grey clay at the depth of four fathoms. In some places also they are met with in a kind of red ochre, which is attracted by the magnet; in others they are found in the clefts of rocks. The beautiful green chrysoprasus is found most plentifully in the mountain of Glassendorf. In another mountain named Kosmutz, where it is also found, the pieces are so porous, and so much spotted with white, &c. that sometimes upwards of 1000 of them have not afforded one large enough for the use of the jewellers. The defects are frequently only discoverable on polishing, as the green opal, while rough, perfectly resembles the chrysoprasus; but, on polishing the stones in which it is contained, it is detected by its want of lustre.

The quantity in which these stones are found is not sufficient to afford the expences of regular mining; the most profitable way, therefore, of obtaining them is by making trenches in the earth from four to six feet deep. Almost all the mountain of Kosemutz, however, has already been examined in this manner; so that they now dig for the chrysoprasus in quarries by uncovering a bank of earth or stone, and descending to other banks by steps in the open air, so as to throw the rubbish back from bank to bank. This method, however, cannot be continued farther than 24 or 30 feet, otherwise the produce would not defray the expence. The only tools employed in digging for the chrysoprasus are a spade and pick-ax; the former to remove the earth, the latter to detach the chrysoprasus itself from the stones which surround it.

Various accounts have been given of the component parts of this precious stone. Lehmann thinks, that the

Siliceous Earths. Gems.

purple or rosy colour, or inclining to the blue; very often they are semi-transparent, without any colour in one end, and violet towards the other. The best are found in the Vic mountains of Catalonia in Spain, and at Wiesenthal in Saxony, as well as in Bohemia in Germany, in Italy, and in the province of Auvergne in France.

Crystals within the geodes, or hollow agatheballs, are very often found of an amethyst colour, and some are very fine.

What we call *amethyst root*, or *mother of amethyst*, is but a sparry fluor, of which we have plenty in Derbyshire: many fine ornamental pieces are made of this substance in different forms and shapes. These spars are found in insulated masses, sometimes pretty large; but never in the form of large rocks.

VII. The garnet, (*Granatus.*) This stone, when transparent and of a fine colour, is reckoned among the gems: but it varies more than any, both in the form of its crystals and in its colour, some being of a deep and dark red, some yellowish and purplish, and some brown, blackish, and quite opaque. In general, their lustre is less than that of other gems, as well as their hardness, which yields to the file, although they may strike fire with steel. But as to their form, these crystals take almost all sorts of figures, as the rhomboidal, tetradecaedral, &c. and some are of an irregular form.

Their colour proceeds from the iron which enters into their composition; and, according to M. de Saussure, even the finest oriental garnets attract the magnetic needle at a small distance.

The Syrian garnet is the finest and best esteemed. It is of a fine red, inclining to the purple colour, very diaphanous, but less brilliant than the oriental amethyst. It seems to be the *amethystizontas* of Pliny: the Italians call it *rubino di rocca*,

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the colour of it is owing to some ferruginous particles modified in a particular manner: but the experiments he adduces for this opinion are not satisfactory. Mr Sage attributes the colour to cobalt from the blue colour it imparts to glass. Mr Achard thinks the stone contains calx of copper as well as calx of iron; because a part of the metal separable from it may be dissolved in volatile alkali. The following are the experiments of M. Klaproth upon the subject.

1. On heating several pieces of very pure chrysoprasus red hot, and quenching them in water, the colour was changed from green to bluish grey; and, on repeating the operation, it became a white grey. They were found to have lost in weight one and an half per cent. and were easily pulverable in a glass mortar.

2. Three hundred grains of chrysoprasus were mixed with double its weight of mild mineral alkali, and the mixture heated for some hours red hot, in a porcelain crucible. The mass was then powdered, and digested in distilled water. By filtration, a yellowish grey residuum was obtained, weighing 44 grains; the filtered liquor was limpid and colourless, a copious precipitate being formed with muriatic acid, which being washed and dried was found to be siliceous earth.

3. The 44 grains of yellowish grey residuum were digested in a retort, with 352 grains of aqua regia; a great part of which was evaporated. The acid which came over was returned into the retort, and filtered after a second digestion. The residuum was a very fine white siliceous earth, which, after being washed, dried, and heated red hot, weighed 20 grains.

4. The filtrated solution was of a pale green, but on supersaturation with volatile alkali immediately turned of a bluish colour, precipitating a small quantity of brownish gelatinous matter; which, when collected, twice distilled with nitrous acid, and afterwards strongly heated, yielded a brown calx of iron, weighing no more than a quarter of a grain: whence our author concludes, that iron does not contribute to the colour of the chrysoprasus, as we know many colourless stones which contain as great a quantity of that metal. This small quantity of calx was left after digesting the gelatinous residuum. On precipitating the soluble parts, they appeared to consist of aluminous earth, in an excessively divided state; which being washed and dried, weighed half a grain.

5. To find whether the solution contained calcareous earth or not, he mixed with that, supersaturated with volatile alkali, a saturated solution of mild mineral alkali, which precipitated four grains and an half of white and very pure calcareous earth.

6. Nothing more was precipitated from the solution, either by acids or alkalies, after the separation of the calcareous earth, though it still retained a bluish colour. It was poured into a retort, and evaporated to dryness; the residuum was of a yellowish colour, which became green on being dissolved in distilled water. Mild mineral alkali threw down only a little earth of a greenish white colour; which being re-dissolved in dephlogisticated nitrous acid, and precipitated with Prussian alkali, the liquor yielded 17 grains of a sea-green powder. This precipitate, in our author's opinion, is the colouring principle of the chrysoprasus; and this principle he afterwards found to be calx of nickel.

7. Our author likewise attempted to analyse the chrysoprasus in the moist way by concentrated vitriolic acid; in which process his chief view was to discover whether or not the stone contained any volatile particles or not. On an ounce of crude chrysoprasus, therefore, when put into a retort, he poured an equal quantity of rectified vitriolic acid, and two parts of distilled water. After the latter had passed over into the receiver, the fire was increased to force over the superabundant acid; a part arose in white vapours, and some fell into the receiver with an hissing noise. Boiling water, which had been distilled, was then poured upon the residuum, and the solution filtered. The powdered chrysoprasus left on the filter had not been perfectly dissolved, and, in

rocca, and is found in Syria, Calcutta, Cananor, Camboya, and Ethiopia.

The fine garnet of a red inclining to a yellow colour, is the *soranus* of the ancients, the *vermeille* of the French, and the *giacinto guarnacino* of the Italians. Its name is taken from *Sorian*, or *Surian*, a capital town of Pegu, from whence these gems are brought: when they have a brownish taint, they are then called *hyacinths*.

The occidental garnet is of a deep and dark red, and its hardness is lesser. However, some very fine hard garnets are found in Bohemia.—Garnets are also found in Hungary, at Pyrna in Silesia, at S. Sapho in the canton of Berne, in Spain, and in Norway.

The garnet melts in the focus of a good burning glass into a brown mass, which is attracted by the loadstone; and this shows that iron enters considerably into its composition.

Some garnets are found, which contain a little gold. Those called *zingraupen* by the Germans contain tin.

VIII. Tourmalin; *Lapis electricus*.

This is a kind of hard stone, lately brought into notice by its electrical properties. See TOURMALIN.

1. Its form is a prism of nine sides of different breadths, mostly truncated, and seldom terminating in a pyramid at each end, which is either composed of three pentagons, or of nine triangles.
2. When heated in the fire, it gives signs of contrary electricity on the two opposite ends of their prismatic form. But many of these stones are not in the least electric. However, on being rubbed, they become electric in their sides, like other diaphanous gems.
3. It is as hard almost as the topaz, and strikes fire with steel.
4. It melts by itself in a strong fire, though with difficulty.
5. With the microcosmic salt it melts perfectly; but only in part with borax.
6. With mineral alkali it is divided into a kind of powder.
7. The three mineral acids dissolve it when first reduced to a powder.
8. It bears a greater similarity to schoerl than to any other stone: but its component parts show

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in general, had undergone but little alteration, so that he could not by this method determine the component parts. M. Achard, however, was more successful, and by a similar method determined the component parts of this gem to be five grains of an earth, which, distilled with vitriolic acid, became volatile; eight grains of calcareous earth, six grains of magnesia, two grains of calx of iron, three grains of calx of copper, and 456 of siliceous earth.

M. Klaproth never met with any volatile earth or magnesia in his experiments on this gem; and therefore concludes, that the chrysoprasus used by him had been essentially different from that made use of by M. Achard; and he seems not to give credit to the account of any copper being found in it.

8. One part of crude chrysoprasus, well powdered and washed with two parts of mild vegetable alkali, yielded a violet-coloured glass, which in the atmosphere ran into a brownish-coloured liquor.

9. Five parts of the gem, with four of mild alkali, gave a beautiful violet-coloured glass after being two hours in fusion.

10. Equal parts of crude chrysoprasus and mild mineral alkali, yielded a transparent glass in thin laminæ, of a brown colour, resembling that of the tourmalin, the surface being marked with fine reticulated veins; which veins arose from small grains of very fine reduced nickel placed in lines against one another.

11. Equal parts of crude chrysoprasus and calcined borax, gave a clear, transparent, and brown glass, resembling the smoky topaz.

12. Equal parts of chrysoprasus, extracted by vitriolic acid and calcined borax, yielded a similar glass of a clear brown colour; "which proves (says our author), that the vitriolic acid was incapable of perfectly analysing the chrysoprasus, though I had used a double portion of the earth."

13. Eighty grains of prepared siliceous earth, sixty grains of mild fixed alkali, with three grains of calx of nickel procured from the chrysoprasus, yielded a beautiful, clear, and violet-coloured glass.

14. On substituting three grains of calx produced from an ore of nickel, a glass was produced exactly like the former.

15. Sixty grains of prepared siliceous earth and calcined borax, with three grains of calx of nickel from the chrysoprasus, yielded a transparent glass of a clear brown colour.

16. Sixty grains of prepared siliceous earth and vitrified phosphoric acid, with three grains of calx of nickel from the chrysoprasus, gave a glass of the colour of honey.

17. Thus the attempts of M. Klaproth to recompose the chrysoprasus proved abortive. From his experiments, however, he deduces the following conclusions: 1. The blue colour observable in the glass produced by fusing the chrysoprasus with vegetable alkali, arises entirely from the nickel contained in the gem; and the experiment shows that the calx of nickel, when purified as much as possible, has the surprising property of tinging glass frits prepared with vegetable alkali of a blue colour. "But (says he) why was not this colour also obtained with soda? and what is the cause of a difference so little to be expected?" 2. By these experiments the supposition of M. Sage is refuted, that the metallic matter which colours the chrysoprasus is cobalt: "many metallic substances besides cobalt, it is well known, give by certain processes a blue glass; thus cobalt,

show that it may be ranged with propriety in this place, along with other precious stones: as the argillaceous earth is also the most prevalent in its composition.

a. The oriental tourmalines are found in the island of Ceylon. They are transparent, of a dark brown yellow; and their specific gravity is from 3062 to 3295.

b. From Brasil. Transparent. These are green for the most part; but there are also some red, blue, and yellow; their specific gravity is from 3075 to 3180.

c. From Tyrol. Of so dark a green as to appear opaque. Their specific gravity is about 3050. These are found in beds of steatites and lapis-ollaris, among the micaceous veins, talcs, and hornblende of Schneeberg, Jurzagl, and Zillerthal, in the mountains of Tyrol.

d. From the mountains of Old Castile in Spain. These are transparent, and have the same properties as the preceding ones.

IX. The opal, *Opalus;* the *girasole* of the Italians.—This is the most beautiful of all the flint kind, owing to the changeable appearance of its colours by reflection and refraction, and must therefore be described under both these circumstances.

1. The opal of Nonnius, the *Sangenon* of the Indians. This appears olive-coloured by reflection, and seems then to be opaque; but when held against the light, is found transparent and of a fine ruby red colour.

There is, however, another of the same kind in Sweden, which by reflection appears rather brown; but by refraction it is red, with violet veins.

2. The white opal. Its ground is white, of a glass-like complexion, from whence are thrown out green, yellow, purple, and bluish rays; but it is of a reddish or rather flame-colour when held against the light.

a. Of many colours; the oriental opal.

b. Of a milky colour.

c. Bluish, and semi-transparent. This is not so much valued as those which are more opaque, because it is easier to be imitated by art.

§ 2. *Of Quartz.*

This stone is very common in Europe, and easier to be known than described. It is distinguished from the other kinds of the siliceous order by the following qualities.

1. That it is most generally cracked throughout, even in the rock itself; whereby,
2. As well as by its nature, it breaks irregularly, and into sharp fragments.
3. That it cannot easily be made red-hot without cracking still more.
4. It never decays in the air.
5. Melted with pot-ashes, it gives a more solid and fixed glass than any other of the siliceous order.
6. When there has been no interruption in its natural accretion, its substance always crystallises into hexagonal prisms pointed at one or both ends.
7. It occurs in clefts, fissures, and small veins in rocks. It very seldom forms large veins, and still seldomer whole mountains, without being mixed with heterogeneous substances.

According to Mr Kirwan, quartz neither loses its hardness nor its weight by calcination. Its texture is lamellar. These stones are in general the purest of the siliceous kind, though most contain a slight mixture of other earths; the most obvious distinction among them arises from their transparency or opacity.

Quartz is found,

(1.) Pure.

A. Solid, of no visible particles, with a glossy surface. Fat quartz.

a. Uncoloured and clear. This has no crystallised form, but is nevertheless as clear as quartz crystals of the best water.

b. White, the common fat quartz.

c. Blue

cobalt gives a blue colour to combinations of the mineral alkali with phosphoric acid, to mineral alkali itself, to potash, and to borax. The acid of tungsten (falsely so called) also gives a blue colour to frits made with phosphoric salts, but not to those made with borax; the calx of nickel gives a blue colour only to frits made with potash, brown to those with mineral alkali and borax, and yellow, like honey, to combinations of phosphoric acid with mineral alkali." 3. As the chrysoprasus gives a brown colour with borax, and the solution of this stone in muriatic acid gives no signs of cobalt dissolved in the same acid; this shows that there is no cobalt in the stone. Mr Sage, indeed, pretends, that he has obtained a blue glass from the chrysoprasus and borax; but this is contradicted by experience. 4. The mineralogical character of the chrysoprasus, therefore, is a quartz coloured green by nickel. Three hundred grains of it contain 288¼ of siliceous earth calcined to redness, one quarter of a grain of pure aluminous earth, two grains and an half of calcareous earth calcined to redness, three grains of calx of nickel, and one quarter of a grain of calx of iron. All these were extracted in the experiments; and there were besides five grains and an half of waste.

Our author mentions, that in the collections of chrysoprasus which have been brought to him, he has constantly observed green opal, in bits of vein from half an inch to an inch, and fixed in its borders: the reddish, yellow, and white opals, on the contrary, are generally met with on a green or brownish petrofilex. But the white opal, which, as well as the green, is found in pieces of the nature of matrix, differs from the true opal, approaching the chalcedony and the opaque milky quartzes. This kind of transparent opal, radiated with a whitish blue, contains the following ingredients in its composition: Siliceous earth, 237 grains; aluminous earth, a quarter of a grain; calx of iron, a quarter of a grain—in all, 237½ grains. In 240 grains were two and an half of waste. The colour of this stone, as well as the chrysoprasus, in our author's opinion, is derived from nickel.

Siliceous Earths. *Gems.*

c. Blue.
d. Violet.
B. Grained.
a. White. *b.* Pale green.
C. Sparry quartz.
This is the ſcarceſt; and ought not to be confounded with the white felt-ſpat, being of a ſmoother appearance, and breaking into larger and more irregular planes.
a. Whitiſh yellow. *b.* White.
D. Cryſtalliſed quartz. Rock cryſtal. Quartz cryſtal.
1. Opaque, or ſemi-tranſparent.
a. White, or of a milk colour.
b. Red, or of a carnelian colour.
c. Black.
2. Clear.
a. Blackiſh brown, ſmoky topaz, or *raunch topaz* of the Germans.
b. Yellow; found in Bohemia, and ſold inſtead of topazes.
c. Violet; the amethyſt from Saxony, Bohemia, and Dammemore in Upland (B.)
d. Uncoloured; rock cryſtal, properly ſo called. When theſe coloured cryſtals are not clear, they are called *fluſs;* for inſtance, *topaz-fluſs, amethyſt-fluſs,* &c. (C.)
(2.) Impure quartz.
A. Mixed with iron, in form of a black calx.—This is of a gloſſy texture, and contains a great quantity of iron.
B. Mixed with copper in form of a red calx.
a. Red.

§ 3. *Of Flints.*

The flint (*Silex pyromachus, Lapis corneus,* or the *hornſtein* of the Germans) forms a kind of intermediate ſubſtance between quartz and jaſper; both which, however, it ſo nearly reſembles, that it is not eaſy to point out ſuch characters as ſhall readily diſtinguiſh it from them. We can only, therefore, ſpeak of its properties comparatively.

1. It is more uniformly ſolid, and not ſo much cracked in the maſs as the quartz; and,
2. It is more pellucid than the jaſper.
3. It bears being expoſed to the air without decaying better than the jaſper, but not ſo well as the quartz.
4. It is better for making of glaſs than the jaſper, but is not quite ſo good as quartz for that purpoſe.
5. Whenever there has been an opportunity in this matter of its ſhooting into cryſtals, quartz cryſtals are always found in it; juſt as if the quartz made one of its conſtituent parts, and had in certain circumſtances been ſqueezed out of it: this is to be ſeen in every hollow flint, and its clefts, which are always filled up with quartz.
6. It often ſhows moſt evident marks of having been originally in a ſoft and ſlimy tough ſtate like glue or jelly.

The ſeveral varieties of this ſpecies have obtained more diſtinct names with reſpect to their colours than from any real difference in their ſubſtance; but theſe are ſtill neceſſary to be retained, as the only names uſed by jewellers and others, who know how to value them accordingly.

I. Jade. *Lapis nephriticus. Jaſpachates.*
The true lapis nephriticus ſeems to belong to this ſiliceous order, as it gives fire with ſteel, and is ſemi-pellucid like flint; it does not harden

(B) The moſt tranſparent are called *falſe diamonds, Briſtol, Kerry ſtones,* and *Alençon diamonds,* &c. The coloured tranſparent cryſtals derive their tinge generally from metallic calces, though in exceeding ſmall portions: they all loſe their colours when ſtrongly heated. Theſe are what we call falſe gems, viz.
The *red,* from Oran in Barbary, *falſe rubies.*
The *yellow,* from Saxony, *falſe topazes.*
The *green,* from Dauphiny, (very rare) *falſe emeralds,* or *praſes.*
The *violet,* from Vil in Catalonia, *falſe amethyſts.*
The *blue,* from Puy in Valay, France, *falſe ſapphires.*
There are alſo *opal,* or *rainbow cryſtals,* ſome of which make a very fine appearance; the various colours of which are thrown out in zones acroſs the ſurface, though they never ſhine like the oriental opal.

(C) M. Fourcroy makes a remarkable difference between the cryſtals and the quartz, by affirming that the former are unalterable in the fire, in which they neither loſe their hardneſs, tranſparency, nor colour; whilſt the quartz loſes the ſame qualities, and is reduced by it to a white and opaque earth. He claſſes the rock cryſtals,
1ſt, According to their *form,* viz. 1. Inſulated-hexagonal-cryſtals, ending in two pyramids of ſix faces, which have a double refraction, or ſhow two images of the ſame object when looked through. 2. Hexagonal cryſtals united, having one or two points. 3. Tetrædral, dodecædral, flated cryſtals; and which, though hexagonal, have nevertheleſs their planes irregular. 4. Cryſtals in large maſſes, from the iſland of Madagaſcar, which have a ſimple refraction.
2dly, As to the colour, they are either diaphonous, reddiſh, ſmokey, or blackiſh.
3dly, As to accidental changes, ſome are *hollow:* ſome contain *water* within one or more cavities: ſome are caſed, viz. one within the other: ſome are of a round form, as the pebbles of the Rhine: ſome have a cruſt of metallic calces, or of a pyrites: ſome are of a geodical form, viz. cryſtalliſed in the inſide of a cavity; ſome ſeem to contain amianthe, or aſbeſtus, and others contain ſhirls.
The ſame author reckons among cryſtals, the oriental topaz, the hyacinth, the oriental ſapphire, and the amethyſt. Mr Daubenton has always looked on this laſt as a quartzous cryſtal.

den in fire, but melts by the ſolar heat in the focus of a burning lens into a tranſparent green glaſs with ſome bubbles. That called by the name of *circonciſion ſtone*, which comes from the Amazon river, melts eaſier, in the ſame ſolar fire, into a brown opaque glaſs, which is far leſs hard than the ſtone itſelf. (*Macquer.*)

This ſtone is ſuperior in hardneſs to quartz, though from its unctuoſity to the touch, one would ſuſpect it to contain a large portion of argillaceous earth, or rather of magneſian earth, as Mr Kirwan ſeems to ſuſpect.

Its ſpecific gravity is from 2,970 to 3,389.—It is of a granular texture, of a greaſy look, and exceedingly hard: is ſcarcely ſoluble in acids, at leaſt without particular management, and is infuſible in the fire. M. Sauſſure ſeems to have extracted iron from it.

a. It is ſometimes of a whitiſh milky colour, from China; but moſtly

b. Of a greeniſh, or

c. Deep-green colour, from America.

d. Grey, yellowiſh, and olive colour: theſe are the vulgar *lapis nephriticus*, they being ſuppoſed to cure the nephritic pains by their external application to the loins.

The ſemi-pellucidity, hardneſs, and ſpecific gravity, are the characters by which the lapis nephriticus may be diſtinguiſhed from other ſtones.

II. Cat's eye; *Pſeudopalus.* The ſun-ſtone of the Turks, called *guneche.*

This ſtone is opaque, and reflects green and yellowiſh rays from its ſurface: it is found in Siberia. It is very hard and ſemi-tranſparent, and has different points, from which light is reflected with a kind of yellow-brown radiation, ſomewhat ſimilar to the eyes of cats, from whence it had its name. Jewellers do not fail to cut them round to the greateſt advantage. The beſt of theſe ſtones are very ſcarce. One of theſe of one inch diameter was in the cabinet of the grand duke of Tuſcany.

III. *Hydrophanes*, or *Oculus Mundi;* alſo called *Lapis mutabilis.*

The principal property which diſtinguiſhes this from all other ſtones, is that it becomes tranſparent by mere infuſion in any aqueous fluid; but it gradually reſumes its opacity when dry.

IV. The onyx. *Onyx camehuja.* Memphites. It is found of two ſorts.

a. Nail-coloured onyx, having pale fleſh-coloured and white lines.

b. With black and white lines. The oriental onyx.

V. The chalcedony, or white agate, is a flint of a white colour, like milk diluted with water, more or leſs opaque: it has veins, circles, and round ſpots. It is ſaid to be ſofter than the onyx, but much harder than thoſe agates which are ſometimes found of the ſame colour.

a. The white opaque chalcedony, or *caholong*, from the Buckhariſh Calmucks. This was firſt made known by one Renez, a Swediſh officer, who for ſeveral years had been in that country. The inhabitants find this flint on the banks of their rivers, and work idols and domeſtic veſſels out of it.

b. Of white and ſemi-tranſparent ſtrata; from Ceylon.

c. Bluiſh grey; from Ceylon and Siberia.

VI. The carnelian. *Carniolus.*

Is of a browniſh red colour, and often entirely brown. Its name is originally derived from its reſemblance to fleſh, or to water mixed with blood.

a. Red.

b. Yellowiſh brown, looks like yellow amber. It is ſaid not to be ſo hard as the chalcedony.

VII. The ſardonyx.

This is a mixture of the chalcedony and carnelian, ſometimes ſtratumwiſe, and ſometimes confuſedly blended and mixed together.

a. Striped with white and red ſtrata: this ſerves as well cut in cameo as the onyx.

b. White, with red dendritical figures. This very much reſembles that agate which is called the *mocha ſtone;* but with this difference, that the figures are of a red colour in this, inſtead of black, as in that agate.

Between the onyx, carnelian, chalcedony, ſardonyx, and agate, there ſeems to be no real difference, except ſome inexplicable degrees of hardneſs.

VIII. The agate; *Achates.*

This name is given to flints that are variegated with different colours, promiſcuouſly blended together; and they are eſteemed in proportion to their mixture of colours, their beauty, and elegance. Hence alſo they have obtained variety of names, moſtly Greek, as if the buſineſs of the lapidary in cutting of them, and admiring their ſeveral beauties and figures, had been derived from that nation alone (D).

a. Brown opaque agate, with black veins, and dendritical figures; the Egyptian pebble.

b. Of a chalcedony colour; *achates chalcedoniſans.*

c. Semi-tranſparent, with lines of a blackiſh brown colour, and dendritical figures; the mocha ſtone.

d. Semi-tranſparent, with red dots; *Gemma divi Stephani.* When the points are very minute, ſo as to give the ſtone a red appearance, it is by ſome called *Sardea.*

 e. Semi-

(D) On the ſide of a hill near the church of Rothes in Moray, is a quantity of fine agate of elegant red and white colours. It is very hard, heavy, of a ſmooth uniform texture, and of a conſiderable brightneſs; in which the red are remarkably clear, and finely mixed and ſhaded through the ſtone. Mr Williams ſays that this is the largeſt and moſt beautiful agate rock he ever ſaw; and ſo fine and hard as to be capable of the higheſt luſtre in poliſhing.

e. Semi-tranſparent, with clouds of an orange colour.
f. Deep red or violet, and ſemi-tranſparent.
g. Of many colours, or variegated.
h. Black.

IX. Common Flint; *Pyromachus.*

This, in reality, is of the ſame ſubſtance as the agate; but as the colours are not ſo ſtriking or agreeable, it is commonly conſidered as a different ſubſtance.

a. Blackiſh grey, from the province of Skone.
b. Yellow ſemi-tranſparent, from France.
c. Whitiſh grey.
d. Yellowiſh brown.

When the flints are ſmall, they are in England called *pebbles;* and the Swediſh ſailors, who take them as ballaſt, call them *ſingel.*

X. Chert; *Petroſilex, Lapis Corneus.* The *hornſtein* of the Germans.

This is of a coarſer texture than the preceding, and alſo leſs hard, which makes it conſequently not ſo capable of a poliſh. It is ſemi-tranſparent at the edges, or when it is broke into very thin pieces.

a. Chert of a fleſh colour, from Carl-Schakt, at the ſilver-mine of Salberg, in the province of Weſtmanland.
b. Whitiſh yellow, from Salberg.
c. White, from Kriſtierſberg, at Nya Kopparberget in Weſtmanland.
d. Greeniſh, from Preſtgrufvan, at Hellefors in Weſtmanland.

Chert runs in veins through rocks, from whence its name is derived. Its ſpecific gravity is from 2590 to 2700. In the fire, it whitens and decrepitates like ſilex, but is generally ſo fuſible as to melt *per ſe.* It is not totally diſſolved in the dry way by the mineral alkali; but borax and microcoſmic ſalt diſſolve it without effervefcence. Its appearance is duller and leſs tranſparent than common flint. The reddiſh Petro-ſilex uſed in the Count de Lauragar's porcelain manufacture, and called there *felt ſpat,* contained 72 *per cent.* of ſilex, 22 of argill, and 6 of calcareous earth.

There are not yet any certain characters known by which the cherts and jaſpers may be diſtinguiſhed from each other: by ſight, however, they can eaſily be diſcerned, viz. the former (the cherts) appearing tranſparent, and of a fine ſparkling texture, on being broken; whereas the jaſper is grained, dull, and opaque, having the appearance of a dry clay. The chert is alſo found forming larger or ſmaller veins, or in nodules like kernels in the rocks; whereas the jaſper, on the contrary, ſometimes conſtitutes the chief ſubſtance of the higheſt and moſt extended chain of mountains. The chert is likewiſe found plentifully in the neighbourhood of ſcaly limeſtone, as flints in the ſtrata of chalk. What connection there may be between theſe bodies, perhaps time will diſcover.

But flints and agates being generally found in looſe and ſingle irregular nodules, and hardly in rocks, as the chert, it is a circumſtance very inſufficient to eſtabliſh a difference between them; for there is the agate-ſtone, near Conſtantinople, running vein-like acroſs the rock with its country of the ſame hardneſs, and as fine and tranſparent as thoſe other agates which are found in round nodules at Deux-ponts. We muſt, therefore, content ourſelves with this remark concerning flints, viz. That they ſeem to be the only kind of ſtone hitherto known, of which a very large quantity has been formed in the ſhape of looſe or ſeparate nodules, each ſurrounded with its proper cruſt; and that the matter which conſtitutes this cruſt has been ſeparated from the reſt of the ſubſtance, in like manner as ſandiver or glaſs-gall ſeparates from, and ſwims upon, glaſs, during its vitrification; though ſometimes the formation of this cruſt may be prevented by the too ſudden hardening of the matter itſelf.

Other ſpecies of ſtones, which are found in looſe pieces or nodules, except ores and ſome ſorts of ſtalactites, ſhow evidently by their cracks, angles, and irregular figures, that they have been torn from rocks, rolled about, and rubbed againſt one another in torrents, or by ſome other violent motions of water.

That flints had originally been in a ſoft ſtate, M. Cronſtedt obſerves, is eaſy to be ſeen in the Egyptian pebbles, which have impreſſions of ſmall ſtones, ſand, and ſometimes, perhaps, graſs; which, however, have not had any ingreſs into the very flint, but ſeem only to have forced the above agate-gall or cruſt out of the way.

§ 4. *Of Jaſpers.*

Jasper, *jaſpis,* (the *diaſpro* of the Italians), is a name given to all the opaque flints whoſe texture reſembles dry clay, and which have no other known quality whereby they may be diſtinguiſhed from other flints, except that they may be more eaſily melted in the fire; and this quality perhaps may proceed from the heterogeneous mixture, probably of iron.

1. Pure jaſper; which by no means yet known can be decompounded.
   a. Green with red ſpecks or dots; the *heliotrope,* or blood-ſtone. *b.* Green. *c.* Red. *d.* Yellow. *e.* Red with yellow ſpots and veins. *f.* Black.

II. Jaſper containing iron; *Jaſpis martialis Sinople.*

A. Coarſe-grained.
   a. Red and reddiſh brown; *ſinople.*

B. Steel-grained, or fine-grained.
   a. Reddiſh brown: looks like the red ochre or chalk uſed for drawing; and has partition veins, which are unctuous to the touch, like a fine clay, and other like kinds.

C. Of a ſolid and ſhining texture, like a flag.
   a. Liver-coloured; and, *b.* Deep red. *c.* Yellow. This laſt mentioned, when calcined, is attracted by the loadſtone; and being aſſayed, yields from 12 to 15 *per cent.* of iron. (E.)

§ 5.

(E) Near Portſoy in Banff-ſhire is an extenſive rock of jaſper; ſome parts of which contain a beautiful mixture of green and red, which appear finely ſhaded and clouded through the body of the ſtone when poliſhed. Mr Williams is of opinion that it would be a very valuable quarry if worked.

§ 5. *Felt-spars.*

I. Rhombic quartz; *Spatum scintillans.*

This has its name from its figure, but seems to be of the same substance as the jasper. We have not, however, ranked them together, for want of true marks to distinguish the different sorts of the flinty tribe from one another.

This kind is found,

1. Sparry.
   a. White. *b.* Reddish brown. *c.* Pale yellow. *d.* Greenish.
2. Crystallised.
   a. In separate or distinct rhomboidal crystals.

II. Labradore stone; *Spatum rutilum versicolor.*

Its colour is commonly of a light or of a deep grey, and mostly of a blackish grey: but when held in certain positions to the light, discovers different varieties of beautiful shining colours, as lazuly-blue, grass-green, apple green, pea-green; and seldom a citron-yellow; some have an intermediate colour betwixt red-copper and tombac-grey; besides other colours between grey and violet. These colours are seen for most part in spots; but sometimes in stripes, on the same piece.

III. White feltspar; *Terra Silicea Magnesia & ferro intimè mixta.*

This stone has been described by Mr Bayen: and is found at St Marie aux mines in Lorrain. —It is of a white opaque colour, spotted with ochre on the outside.

§ 6. *Of the Garnet Kinds.*

The substances of this *genus* (which is considered by Cronstedt as an *order*) are analogous to gems; since all these are composed of the siliceous, calcareous, and argillaceous earths, with a greater or less proportion of iron. The opaque and black garnets contain about 20 hundredths of iron: but the diaphanous ones only two hundredths of their weight, according to Bergman. The garnets, properly so called, contain a greater quantity of siliceous earth than the shirls, and both are now justly ranked with the siliceous earths.

The species are,

I. Garnet; *Granatus.*

This is a heavy and hard kind of stone, crystallising in form of polygonal balls, and mostly of a red, or reddish brown colour.

A. Garnet mixed with iron; *Granatus martialis.*

1. Coarse-grained garnet-stones, without any particular figure; in Swedish called *Granatberg*; in German, *Granatstein.*
   a. Reddish-brown garnet. *b.* Whitish-yellow. *c.* Pale yellow.
2. Crystallised garnet.
   a. Black. *b.* Red: semi-transparent, and cracked; transparent. *c.* Reddish-yellow; transparent; the jacinth, or hyacinth. *d.* Reddish brown. *e.* Green. *f.* Yellowish-green. *g.* Black.

B. Garnet mixed with iron and tin.

1. Coarse-grained, without any particular figure.
   a. Blackish-brown.
2. Crystallised.
   a. Blackish-brown.
   b. Light-green or white.

C. Garnet mixed with iron and lead.

1. Crystallised.
   a. Reddish-brown.

II. Cockle, or shirl. *Corneous crystallisatus Wallerii; Stannum crystallis columnaribus nigris Linnæi.*

This is a heavy and hard kind of stone which shoots into crystals of a prismatical figure, and whose chief colours are black or green. Its specific gravity is the same as the garnets, viz. between 3000 and 3400, though always proportionable to their different solidity.

A. Cockle, or shirl, mixed with iron.

1. Coarse, without any determined figure.
   a. Green,
2. Sparry.
   a. Deep green, (the mother of the emeralds), from Egypt.
   b. Pale green.
   c. White. This occurs very frequently in the scaly limestones; and its colour changes from deep green to white, in proportion as it contains more or less of iron.
3. Fibrous, striated cockle, or shirl: it looks like fibres or threads made of glass.
   A. Of parallel fibres. *a.* Black. *b.* Green *c.* White.
   B. Of concentrated fibres: The starred cockle, or shirl, from its fibres being laid stellarwise.
   a. Blackish green. *b.* Light green. *c.* White.
4. Crystallised cockle, or shirl.
   a. Black. To this variety belong most of those substances called *imperfect asbesti*; and as the cockle perfectly resembles a flag from an iron furnace, both in regard to its metallic contents and its glassy texture, it is no wonder that it is not soft enough to be taken for an asbestus. It has, however, only for the sake of its structure, been ranked among the asbesti. The striated cockle, or shirl, compared to the asbesti, is of a shining and angular surface (though this sometimes requires the aid of the magnifying glass to be discovered), always somewhat transparent, and is pretty easily brought to a glass with the blow-pipe, without being consumed as the pure asbesti seem to be.
   b. Deep green.
   c. Light green.
   d. Reddish brown. The *tauffstein* is of this colour, and consists of two hexagonal crystals of cockle grown together in form of a cross; this the Roman Catholics wear as an amulet, and is called in Latin *lapis crucifer*, or the cross stone.

The figure of the cockle crystals is uncertain, but always prismatical: the cockle from Yxsio at Nya Kopparberg, is quadrangular: the French kind has nine sides or planes; and the tauffstein is hexagonal.

The name *cockle* for these substances is an old Cornish mineral name; but is also given sometimes to other very different matters.

We

We have not in England any great quantity of fpecies of cockles; the chief are found in the tin mines of Cornwall, and fome fine cryftallifed kinds have been brought from Scotland.

The Englifh mineral name of *call*, has been ufed by fome authors as fynonymous with *cockles*, and they are confounded together at the mines; but the call, definitely fpeaking, is the fubftance called *wolfram* by the Germans, &c.

Garnets, though fmall, are often found in micaceous ftones in England; but extreme good garnets are found in great plenty alfo in like ftones in Scotland.

III. Rowley rag, (*Kirwan.*) This ftone is of a dufky or dark grey colour, with numerous minute fhining cryftals. Its texture is granular: by expofure to the air it acquires an ochry cruft. Its fpecific gravity is 2748. Heated in an open fire it becomes magnetic. In ftrong heat it melts *per fe*, but with more difficulty than bafaltes. According to Dr Withering's analyfis, 100 parts of it contain 47,5 of filiceous earth, 32,5 of argil, and 20 of iron

IV. Siliceous muriatic fpar, (*Id.*) This ftone is of a hard, folid, and fparry texture; of a grey, ochry, dull colour, but internally bright. It gives fire with fteel: yet it effervefces with acids. In a ftrong heat it grows brown; but at laft it melts *per fe*. One hundred parts of this ftone contain fifty parts of filex: the remainder is mild magnefia and iron; but in what proportion is not mentioned (See *Journal de Phyfique*, Supplement, vol. xiii. p. 216.)

V. Turky ftone; *cos Turcica*, (*Id.*) This ftone is of a dull white colour, and often of an uneven colour, fome parts appearing more compact than others, fo that it is in fome meafure fhattery. It is ufed as a whetftone: and thofe of the fineft grain are the beft hones for the moft delicate cutting tools, and even for razors, lancets, &c. Its fpecific gravity is 2598. It gives fire with fteel; yet effervefces with acids. Mr Kirwan found that 100 parts of it contains 25 of mild calcareous earth, and no iron. There probably are two forts of ftones known by this name, as Mr Wallerius affirms, that which he defcribes neither to give fire with fteel nor effervefce with acids.

VI. Ragg ftone. The colour of this ftone is grey. Its texture is obfcurely laminar, or rather fibrous, but the laminæ or fibres confift of a congeries of grains of a quartzy appearance, coarfe and rough. Its fpecific gravity is 2729. It effervefces with acids; and gives fire with fteel. Mr Kirwan found it to contain a portion of mild calcareous earth, and a fmall proportion of iron. It is ufed as a whet-ftone for coarfe cutting tools.

[The filiceous grit, *cos arenarius*, and other compounds of the filiceous earth, &c. will be found in a fubfequent divifion of this article.]

Obfervations on the œconomical Ufes of the Siliceous Order.

THE Europeans have no farther trouble with the precious ftones than either to cut them from their natural or rough figure, or to alter them when they have been badly cut in the Eaft Indies; in which latter circumftances they are called *labora*: and it may be obferved, that for cutting the ruby, fpinell, ballas, and chryfolite, the oil of olive is required, inftead of any other liquid, to be mixed with the diamond powder, in the fame manner as for cutting the diamond itfelf.

If the petty princes in thofe parts of the Indies, where precious ftones are found, have no other power nor riches proportionable to the value of thefe gems, the reafon of it is as obvious as of the general weaknefs of thofe countries where gold and filver abound, *viz.* becaufe the inhabitants, placing a falfe confidence in the high value of their poffeffions, neglect ufeful manufactures and trade, which by degrees produces a general idlenefs and ignorance through the whole country.

On the other hand, perhaps, fome countries might fafely improve their revenues by fuch traffic. In Saxony, for example, there might probably be other gems found befides aqua marines and topazes; or even a greater trade carried on with thefe than at prefent, without danger of bad confequences, efpecially under the direction of a careful and prudent government.

The *half-precious* ftones, fo called, or gems of lefs value, as the common opal, the onyx, the chalcedony, the cornelian, and the coloured and colourlefs rock cryftals, have been employed for ornaments and economical utenfils, in which the price of the workmanfhip greatly exceeds the intrinfic value of the ftones. The ancients ufed to engrave concave and convex figures on them, which now-a-days are very highly valued, but often with lefs reafon than modern performances of the fame kind. Thefe ftones are worked by means of emery on plates and tools of lead, copper, and tin, or with other inftruments; but the common work on agates is performed at Oberftein with grind-ftones at a very cheap rate. When once fuch a manufactory is eftablifhed in a country, it is neceffary to keep it up with much induftry and prudence, if we would wifh it to furmount the caprice of fafhions; fince, howmuchfoever the natural beauties of thefe ftones feem to plead for their pre-eminence, they will at fome periods unavoidably fink in the efteem of mankind; but they will likewife often recover, and be reftored to their former value.

The grindftones at Oberftein are of a red colour, and of fuch particular texture, that they neither become fmooth, nor are they of too loofe a compofition.

Moft part of the flinty tribe is employed for making glafs, as the quartz, the flints, the pebbles, and the quartzofe fands. The quartz, however, is the beft; and if ufed in due proportion with refpect to the alkali, there is no danger of the glafs being eafily attacked by the acids, as has fometimes happened with glafs made of other fubftances, of which we had an inftance of bottles filled with Rhenifh and Mofelle wines during the time of a voyage to China.

In the fmelting of copper ores, quartz is ufed, to render the flag glaffy, or to vitrify the iron; quartz being more ufeful than any other ftone to prevent the calcination of the metal.

The quartzofe fand which conftitutes part of many ftones, and is alfo ufed in making crucibles and fuch veffels,

Argillaceous Earths.

veſſels, contributes moſt of all to their power of reſiſting fire.

It appears likewiſe probable that the quartzoſe matter makes the grind and whetſtone fit for their intended purpoſes. (*Magellan.*)

Order V. *The* Argillaceous Earths.

The principal character whereby thoſe may be diſtinguiſhed from other earths is, that they harden in the fire, and are compounded of very minute particles, by which they acquire a dead or dull appearance when broken.

I. *Argilla aerata; lac lunæ.*

This fanciful name was heretofore thought to denote a very fine ſpecies of calcareous earth; but Mr Screber has lately ſhown, that the earth to which this name is given, is a very uncommon ſpecies of argill. It is generally found in ſmall cakes of the hardneſs of chalk; and like that, it marks white. Its hardneſs is nearly as that of ſteatites, and it does not feel ſo fat as common clay does. Its ſpecific gravity is 1669; its colour ſnow white. When examined with a microſcope, it is found to conſiſt of ſmall tranſparent cryſtals; and by his experiments it appears plainly to be an argill ſaturated with fixed air. It effervesces with acids, and contains a very ſmall proportion of calcareous earth and ſometimes of gypſum, beſides ſome feeble traces of iron. It is found near Halles.

II. Porcelain clay; *Terra porcellanea*, vulgo *Argylla apyra*, very refractory; the *kaolin* of the Chineſe.

(1.) Pure.

A Diffuſible in water.

1. Coherent and dry.

a White.

2. Friable and lean.

a. White.

(2.) Mixed with phlogiſton

A. Diffuſible in water.

a. White and fat pipe clay. *b.* Of a pearl colour. *c.* Bluiſh grey. *d.* Grey. *e.* Black. *f.* Violet.

Theſe contain a phlogiſton, which is diſcovered by expoſing them to quick and ſtrong fire, in which they become quite black interiorly, aſſuming the appearance of the common flints, not only in regard to colour, but alſo in regard to hardneſs: but if heated by degrees, they are firſt white, and afterwards of a pearl colour. The fatter they ſeem to be, which may be judged both by their feeling ſmooth and unctuous, and by their ſhining when ſcraped with the nail, they contain a larger quantity of the inflammable principle. It is difficult to determine, whether this ſtrongly inherent phlogiſton be the cauſe of the above-mentioned pearl-colour, or prevents them from being burnt white in a ſtrong fire; yet no heterogeneous ſubſtance can be extracted from them, except ſand, which may be ſeparated from ſome by means of water; but which ſand does not form any of the conſtituent parts of the clays. If they be boiled in aqua regis in order to extract any iron, they are found to loſe their viſcoſity.

III. Stone-marrow; *Lithomarga. Keſſekil* of the Tartars.

1. When dry, it is as fat and ſlippery as ſoap; but,

2. Is not wholly diffuſible in water, in which it only falls to pieces, either in larger bits, or reſembles a curd-like maſs.

3. In the fire it eaſily melts to a white or reddiſh frothy ſlag, conſequently is of a larger volume than the clay was before being fuſed.

4. It breaks into irregular ſcaly pieces.

A. Of coarſe particles: Coarſe ſtone-marrow.

a. Grey.

b. Whitiſh yellow, from the Crim Tartary, where it is called *keſſekil*; and is ſaid to be uſed for waſhing inſtead of ſoap.

B. Of very fine particles; fine ſtone-marrow.

a Yellowiſh brown; *Terra Lemnia.*—Is of a ſhining texture, falls to pieces in the water with a crackling noiſe; it is more indurated than the preceding, but has otherwiſe the ſame qualities.

IV. Bole, (iron clay.)

This is a fine and denſe clay of various colours, containing a great quantity of iron, which makes it impoſſible to know the natural and ſpecifical qualities of the bole itſelf, by any eaſy method hitherto in uſe. It is not eaſily ſoftened in water, contrary to what the porcelain and the common clays are, (I. & VI.); but either falls to pieces in form of ſmall grains, or repels the water, and cannot be made ductile. In the fire it grows black, and is then attracted by the loadſtone.

A. Looſe and friable boles, or thoſe which fall to a powder in water.

a. Fleſh-coloured bole.

b. Red:

1. Fine; *Bolus Armenus.*

2. Coarſe; *Bolus communis officinalis.*

3. Hard: *Terra rubrica.*

c. Green; *Terre verte.*

1. Fine.

2. Coarſe.

d. Bluiſh-grey, is ductile as long as it is in the rock, but even then repels the water; it contains 40 per cent. of iron; which metal being melted out of it in a cloſe veſſel, the iron cryſtalliſes on its ſurface.

e. Grey.

1. Cryſtalliſed in a ſpherical polygonal figure.

2. Of an undeterminate figure.

B. Indurated bole.

A. Of no viſible particles.

This occurs very often in form of ſlate, or layers, in the earth; and then is made uſe of as an iron ore. However, it has uſually been conſidered more in regard to its texture than to its conſtituent parts; and has been called *ſlate*, in common with ſeveral other earths which are found to have the ſame texture.

a. Reddiſh-brown; in moſt collieries, between the ſeams of coal.

b. Grey.

B. Of ſcaly particles.—The *hornblende* of the Swedes.

Argillaceous Earths.

It is distinguished from the martial glimmer, or mica, by the scales being less shining, thicker, and rectangular.

a. Black.—This, when rubbed fine, gives a green powder.

b. Greenish.

V. Zeolyte.

This is described in its indurated state in the Transactions of the academy of sciences at Stockholm for the year 1756, and there arranged as a stone *sui generis* in regard to the following qualities.

1. It is a little harder than the fluors and the other calcareous spars; it receives, however, scratches from the steel, but does not strike fire with it.
2. It melts easily by itself in the fire, with a like ebullition as borax does, into a white frothy slag, which cannot without great difficulty be brought to a solidity and transparency.
3. It is more easily dissolved in the fire by the mineral alkali (*sal sodæ*), than by borax or the microcosmic salt.
4. It does not ferment with this last salt, as lime does; nor with the borax, as those of the gypseous kind.
5. It dissolves very slowly, and without any effervescence, in acids, as in oil of vitriol and spirit of nitre. If concentrated oil of vitriol be poured on pounded zeolites, a heat arises, and the powder unites into a mass.
6. In the very moment of fusion it gives a phosphoric light.

There have lately been discovered some of the zeolites, particularly at Adelfors's gold mines in Smoland, in Sweden; of which some sorts do not melt by themselves in the fire, but dissolve readily in the acid of nitre, and are turned by it into a firm jelly.

The zeolyte is found in an indurated state:

(1.) Solid, or of no visible particles.

A. Pure.

a. White.

B. Mixed with silver and iron.

a. Blue, *Lapis lazuli.*

(2.) Sparry zeolite. This resembles a calcareous spar, though it is of a more irregular figure, and is more brittle.

a. Light red, or orange-coloured.

(3.) Crystallised zeolite. This is more common than the two preceding kinds; and is found,

A. In groupes of crystals, in form of balls, and with concentrical points.

a. Yellow.

b. White.

B. Prismatical and truncated crystals.

a. White.

C. Capillary crystals, which are partly united in groupes, and partly separate. In this latter accretion they resemble the capillary or feathery silver ore; and are perhaps sometimes called *flos ferri*, at places where the nature of that kind of stone is not yet fully known.

a. White.

VI. Tripoli.

This is known by its quality of rubbing or wearing hard bodies, and making their surfaces to shine; the particles of the tripoli being so fine as to leave even no scratches on the surface. This effect, which is called *polishing*, may likewise be effected by other fine clays when they have been burnt a little. The tripoli grows somewhat harder in the fire, and is very refractory: it is with difficulty dissolved by borax, and still with greater difficulty by the microcosmic salt. It becomes white when it is heated: when crude, it imbibes water, but is not diffusible in it: it tastes like common chalk, and is rough or sandy between the teeth, although no sand can by any means be separated from it. It has no quality common with any other kind of earth, by which it might be considered as a variety of any other. That which is here described is of a yellow colour, and is sold by druggists. This kind of tripoli has been lately discovered in Scotland. But the *rotten-stone*, so called, is another sort found in England, viz. in Derbyshire. It is in common use in England among workmen for all sorts of finer grinding and polishing, and is also sometimes used by lapidaries for cutting of stones, &c.

The tripoli is found,

1. Solid: of a rough texture.

a. Brown.

b. Yellowish.

c. Spotted like marble.

2. Friable and compact.

a. Granulated.

b. Brown.

c. Yellowish.

VII. Common clay, or brick clay.

This kind may be distinguished from the other clays by the following qualities:

1. In the fire it acquires a red colour, more or less deep.
2. It melts pretty easily into a greenish glass.
3. It contains a small quantity of iron and of the vitriolic acid, by which the preceding effects are produced.

It is found,

A. Diffusible in water.

1. Pure.

a. Red clay.

b. Flesh-coloured, or pale-red.

c. Grey.

d. Blue.

e. White.

f. Fermenting clay.

2. Mixed with lime. See MARLE, above.

B. Indurated.

1. Pure.

a. Grey slaty.

b. Red slaty.

2. Mixed with phlogiston, and a great deal of the vitriolic acid. See *ALUM Ores*, above.

3. Mixed with lime. See LIME, above.

VIII. Argillaceous fissile stones.

These and many other different kinds of earth have been comprehended under the denomination of

of *schisti*; but to avoid ambiguity we will confine this name to stones of the argillaceous kind.

1. The bluish purple schistus, or common roof slate; *schistus tegularis*.
   Its colour varies to the pale, to the slightly purple, and to the bluish.
   a. The dark-blue slate, *schistus scriptorius*.
2. The pyritaceous schistus.
   This is of a grey colour, brown, blue, or black.
3. The bituminous schistus.
   This is generally black, of a lamellar texture, and of different degrees of hardness.
4. Flag stone.
   This is of a grey, yellowish, or reddish white colour.
5. The argillaceous grit.
   This is called also *sand stone* and *free stone*, because it may be cut easily in all directions.
6. *Killas*.
   This stone is of a pale grey or greenish colour; either lamellar, or coarsely granular. It is found chiefly in Cornwall.
7. *Toadstone*.
   Dr Withering, who has given an analysis of this stone, describes it as being of a dark brownish grey colour, of a granular texture, not giving fire with steel, nor effervescing with acids. It has cavities filled with crystallised spar, and is fusible *per se* in a strong heat. It is found in Derbyshire. See Toadstone.

For the œconomical uses of the argillaceous earths, see the article Clay.

[The compounds of this and other earths will fall to be mentioned under a subsequent division.]

Class II. SALTS.

By this name those mineral bodies are called which can be dissolved in water, and give it a taste; and which have the power, at least when they are mixed with one another, to form new bodies of a solid and angular shape, when the water in which they are dissolved is diminished to a less quantity than is required to keep them in solution; which quality is called *crystallisation*.

In regard to the principal known circumstances or qualities of the mineral salts, they are divided into

1. Acid salts, or mineral acids.
2. Alkaline salts, or mineral alkalies.

Order I. Acid Salts.

For the characters, properties, and phenomena of these, see the article Acid, and Chemistry-*Index*.

Till of late no more mineral acids were known than the vitriolic and marine; the boracic or sedative salt being reckoned as produced artificially: but later discoveries have proved that we may reckon at least *eleven mineral acids;* out of which only two or three have been found in an uncombined state. Those hitherto known are the following, viz. the *vitriolic*, the *nitrous*, the *marine*, the *sparry*, the *arsenical*, the *molybdenic*, the *tungstenic*, the *phosphoric*, the *boracic*, the *succinous*, and the *aerial*. See the article Acid, and Chemistry-*Index*.

I. The vitriolic acid. See Chemistry-*Index*.
II. Nitrous acid.
   This acid is by some excluded from the mineral kingdom, because they suppose it to be produced from putrefaction of organic bodies. But these bodies, when deprived of life, are again received amongst fossils, from whence their more fixed parts were originally derived. For the nature of this acid, see Chemistry-*Index*.
III. Acid of common or sea-salt. See Chemistry-*Index*, at *Acid* and *Marine*.
IV. The *fluor* acid, or sparry fluor acid. See Chemistry-*Index*.
   This acid is obtained by art, as it has never been found disengaged, but united, to calcareous earth, forming a sparry fluor *, called *Derbyshire fluor*, *Cornish fluor*, *blue John*, or *amethyst root*, when of a purple colour. See p. 72. col. 2. concerning the substances arising from the combination of this acid with calcareous earth.

   * See Fluor Spar
V. The acid of *arsenic*. See Chemistry-*Index*.
VI. The acid of *molybdena*. *Ibid*.
VII. The acid of *tungsten*. *Ibid*.
VIII. The *phosphoric* acid. *Ibid*.
IX. The *boracic* acid. *Ibid*.
X. The succinous or *amber* acid. *Ibid*.
XI. Aerial acid, or *fixed air*. *Ibid*.

Order II. Alkaline Mineral Salts.

For the characters, properties, and phenomea of these, see the article Alkali; also Chemistry-*Index*, at *Alkali* and *Alkalies*.

New acids are daily detected; but no additions have been made to the three species of alkali long since known.

These alkaline salts are,

I. Vegetable fixed alkali (a.)

(a) With regard to the origin of the vegetable fixed alkali, there are sufficient proofs that it exists already formed in plants, and also that a portion is formed by combustion: but in each case, the alkali is obtained in an impure state through the admixture of other matters, which must be separated before it can be used for chemical purposes.

The *cendres gravelées* are made by burning the husks of grapes and wine lees. They contain the purest alkali met with in common, and are used by the dyers.

Pot-ash is made by burning wood and other vegetables. This alkali is much phlogisticated, and contains many foreign and saline matters, which, however, may be separated.

That which is obtained from the ashes of wood burned in kitchens is the most pure of all. On the contrary,

Alkaline Salts.

Vegetable fixed alkali, deprived of every acid, is not found any where by itself; but it is sometimes met with in combination with the vitriolic acid or the muriatic, generally with the nitrous, rarely with the aerial (B.)

The fixed vegetable alkali (or *potasse* of Morveau), is of a powdery appearance, and of a dead white colour. When pure, it is much more caustic than the neutral salt; it forms with the aerial acid, and even corrodes the skin (C.)

1. It changes the blue colours of vegetables into a deep green.
2. It has no smell when dry; but when wetted, it has a slight lixivious odour.
3. Its taste is strongly acrid, burning, caustic, and urinous (D). This last sensation arises from the volatile alkali it disengages from animal substances.
4. When exposed to the air, it attracts humidity, and is reduced into a transparent colourless liquor. According to Gellert, it attracts three times its own weight of water.
5. It likewise attracts sometimes the aerial acid from the atmosphere, and is thereby deprived of its property of deliquescing.
6. When it is dissolved in an equal weight of water, it has an oily feel, owing to its action on the fatty parts of the skin, whence it is, though improperly, called *oil of tartar*.
7. In a moderate heat it melts; but in a more violent fire, it is dispersed or volatilized.
8. It is a most powerful solvent by the dry way: in a proper heat, it dissolves calcareous, argillaceous, siliceous, and metallic earths: and when the alkali is nearly equal in quantity to the earth, it forms various kinds of hard, solid, and transparent glass.
9. But if the alkali be in quantity three or four times that of the earth, the glass is deliquescent.
10. The mild vegetable alkali unites with the vitriolic acid with a violent effervescence, and produces vitriolated tartar.
11. With the nitrous acid, it forms the crystallisable salt, called *nitre*.
12. With the marine acid it forms a kind of salt less grateful than common salt, which is called the *febrifuge salt of Sylvius*.
13. With vinegar it forms a neutral deliquescent salt of a sharp taste, called *terra foliata tartari*.
14. With cream of tartar it forms tartarized tartar.
15. It dissolves sulphur, and forms the substance called *liver of sulphur*, which is a powerful solvent of metallic substances.
16. It attracts the metals, and dissolves some of them with peculiar management. Silver, mercury, and lead, are more difficultly dissolved than gold, platina, tin, copper, and especially iron. The last gives a fine reddish saffron colour, first observed by Stahl, who called it the *martial alkaline tincture*.
17. It dissolves in the dry way all the dephlogisticated metallic calces.
18. It unites with oils and other fat substances, with which it forms soap.
19. This alkali becomes opaque when exposed to the flame of the blow-pipe: it decrepitates a long time, and forms a glassy button, which is permanent in the little spoon; but is absorbed with some noise on the charcoal when blown upon it.

II. Fossile fixed alkalis.

A. Alkali of the sea, or of common salt (E.)

1. Pure.

This has nearly the same qualities with the lixivious salt, which is prepared from the ashes of burnt vegetables. It is the same with the *sal sodæ*, or kelp: for the kelp is nothing else than the ashes remaining, after the burning of certain herbs that abound in common salt; but which common salt, during the burning of those vegetables, has lost its acid (F).

The properties of the fossile alkali are as follows:

1. It

trary, that which is got from tartar, properly burned, then dissolved in boiling water, and purified by filtration and crystallisation, is called *salt of water*. It is the best.

(B) The vegetable alkali is seldom found in the earth, except in wells of towns, as at Doway, or in the argillaceous alum-ore of la Tolfa: it is found also united to the nitrous acid, near the surface of the earth, in Spain and in the East-Indies, probably from the putrefaction of vegetables.

(C) Common vegetable alkali, salt of tartar, and pot-ash, were formerly considered by chemists as simple alkalis; but Dr Black has demonstrated them to be true neutral salts, arising from the combination of the vegetable alkali with the aerial acid. From hence it follows, that the above common alkalies, even after any other extraneous substance has been extracted, must be freed from this acid, by putting each in a crucible, and exposing it to a strong fire, which will dissipate this aerial acid. The alkali so purified, is to be put in a glass vial before it be entirely cold, and kept close with a proper stopple; otherwise the aerial acid which floats in large quantities on the atmosphere will combine again with the pure alkali. (*Mongez*.)

(D) The alkali must be largely diluted with water, in order to be tasted; otherwise it will act on the tongue, and corrode the parts where it touches. (*Macquer*.)

(E) This salt is not met with pure in Europe; but it is said to be found in both the Indies, not only in great quantity, but likewise of a tolerable purity: it is there collected in form of an efflorescence in the extensive deserts, a profitable trade being carried on in it for the making of soap and glass; and, therefore, it is very probable that the ancients meant this salt by their *natron* or *baurach*. (*Magellan*.)

(F) The mineral alkali is often combined with the vitriolic and marine acid, and also with the aerial acid;

1. It effervefces with acids, and unites with them.
2. Turns the fyrup of violets to a green colour.
3. Precipitates fublimate mercury in an orange-coloured powder.
4. Unites with fat fubftances, and forms foap.
5. Diffolves the filiceous earth in the fire, and makes glafs with it, &c. It diftinguifhes itfelf from the falt of the pot-afhes by the following properties (G).
6. It fhoots eafily into rhomboidal cryftals; which
7. Fall to powder in the air, merely by the lofs of their humidity (H).
8. Mixed with the vitriolic acid, it makes the *fal mirabile Glauberi.*
9. It melts more eafily, and is fitter for producing the *fal commune regeneratum, nitrum cubicum,* &c. Perhaps it is alfo more conveniently applied in the preparation of feveral medicines.
10. It is fomewhat volatile in the fire.

III. Volatile mineral alkali.

This perfectly refembles that falt which is extracted from animals and vegetables, under the name of *alkali volatile*, or *fal urinofum*, and is commonly confidered as not belonging to the mineral kingdom; but fince it is difcovered, not only in moft part of the clays, but likewife in the fublimations at Solfatara, near Naples, it cannot poffibly be quite excluded from the mineral king-kingdom (I).

Its principal qualities are,

a. In the fire it rifes in *forma ficca*, and volatilifes in the air in form of corrofive vapours, which are offenfive to the eyes and nofe (K).

b. It precipitates the folution of the mercurial fublimate in a white powder.

c. It alfo precipitates gold out of aqua-regia, and detonates with it; becaufe,

d. It has a re-action in regard to the acids, tho' not fo ftrongly as other alkalies.

 e. It

acid; with which laft it retains not only the name but many of the properties of a pure alkali, becaufe this laft acid is eafily expelled.

It is eafily known by its cryftallifation and its folubility in two times and an half of its weight of water, at the temperature of 60 degrees.

One hundred parts of this alkali, when pure and recently cryftallifed, contain 20 of mere alkali, 16 of aerial acid, and 64 of water. (*Macquer.*)

Mineral alkali is found in Hungary, in marfhy grounds, of an argillaceous or marly nature, either mixed with water or cryftallifed and efflorefcing. It is found alfo in Egypt at the bottom of lakes, and dried up by the fummer's heat; and alfo in the province of Suchena, 28 days journey from Tripoli, where it has the name of *Trona;* in Syria, Perfia, as well as in the Eaft-Indies, and China, where it is called *kien.* It fometimes germinates on walls, and is called by many *aphronitron.* In its native ftate, is frequently mixed with magnefian earth, common falt, muriatic magnefia, and marine felenite. (*Kirwan.*)

(G) This mineral alkali likewife differs from the vegetable, 1. By its tafte, which is lefs corrofive and burning. 2. By its not deliquefcing. 3. By the fmall degree of heat it produces if calcined, and afterwards added to water. 4. By its property of cryftallifing, by evaporating the water from its folution, as is practifed with neutral falts; whereas the vegetable alkali does not cryftallife unlefs combined with a large portion of aerial acid.

(H) This alkali being a very ufeful commodity, and effentially neceffary in a number of manufactories, many ingenious proceffes have been contrived and attempted to procure it at a cheap rate, by decompofing the fea-falt; but it is believed, that till lately none of thefe new manufactures have fucceeded, except that of Mr Turner, mentioned by Mr Kirwan in the fecond part of the Philofophical Tranfactions for 1782.—The procefs is faid to confift in mixing a quantity of litharge with half its weight of common falt, which, on being triturated with water till it affumes a white colour, is left to ftand fome hours; after which, a decompofition enfues, the alkali being left alone, whilft the acid unites to the metallic calx; and this laft being urged by a proper degree of fire, produces a fine pigment of a greenifh yellow colour, whofe fale pays for the moft part of the expences.

Mr Kirwan fays, in the place already quoted, that if common falt perfectly dry be projected on lead heated to incandefcence, the common falt will be decompofed, and a horn-lead formed, according to Margraaf. He adds alfo, that according to Scheele, if a folution of common falt be digefted with litharge, the common falt will be decompofed, and a cauftic alkali produced; and, finally, that Mr Scheele decompofed common falt, by letting its folution flowly pafs through a funnel filled with litharge.

(I) It is eafily known by its fmell, though in a mild ftate, by its volatility, and by its action on copper; the folutions of which, in the mineral acids, are turned blue by an addition of this alkali. It is frequently found, though in fmall quantities, in mould, marl, clay, fchiftus, and in fome mineral waters. It probably derives its origin, in the mineral kingdom, from the putrefaction or combuftion of animal or vegetable fubftances. (*Kirwan.*)

The fame is cauftic when uncombined with any acid, not excepting even the aerial acid. It differs from the other two alkalies in many effential particulars. 1. By its aeriform or gafeous nature. For the volatile alkali, in a ftate of purity, is nothing more than an alkaline gas diffufed in water, as Dr Prieftley has demonftrated. 2. By its volatility. 3. By the nature of the falts it forms with acids, which are very different from thofe whofe bafes are formed either of the vegetable or mineral alkali. (*Mongez.*)

(K) Pure volatile alkali, in an aerial form, refembles atmofpheric air, but is more heavy. Its fmell is pene-

Neutral Salts.

e. It tinges the folution of copper blue, and diffolves this metal afrefh if a great quantity is added (L).

f. It deflagrates with nitre, which proves that it contains a phlogifton.

It is never found pure.

Order III. Neutral Salts.

Acids united to alkalies form neutral falts. Thefe diffolved in water are no ways difturbed by the addition of an alkali; and generally, by evaporation, concrete into cryftals. If, by proper tefts, they fhow neither acid nor alkaline properties, they are faid to be *perfect* nautrals; but *imperfect*, when, from defect in quantity or ftrength of one ingredient, the peculiar properties of the other more or lefs prevail.

I. Vitriolated tartar, vitriolated vegetable alkali, or (as Morveau calls it) the *vitriol of pot-afh*.

This is a perfectly neutral falt, which refults from the combination of the vitriolic acid with the vegetable fixed alkali. According to Bergman, it feldom occurs fpontaneoufly in nature, unlefs where tracks of wood have been burnt down: and Mr Bowles, quoted by Mr Kirwan, fays it is contained in fome earths in Spain. See Chemistry-*Index*.

It is eafily obtained, by pouring the vitriolic acid on a folution of fixed vegetable alkali till it is faturated. Cryftals of this neutral falt are then formed. This cryftallifation fucceeds better by evaporation than by cooling, according to Mongez.

The tafte of this falt is difagreeable, though fomewhat refembling common falt.

II. Common nitre, (*Alkali vegetabile nitratum*).

This is known in commerce by the name of *faltpetre*, and is alfo called *prifmatic nitre*, to diftinguifh it from the cubic nitre after-mentioned.—It is perfect neutral falt; refulting from the combination of the nitrous acid with the pure vegetable alkali.

According to Bergman, it is formed upon the furface of the earth, where vegetables, efpecially when mixed with animal-fubftances, putrify.—See Chemistry-*Index*, at *Nitre*.

III. Digeftive falt, falt of Sylvius, (*Alkali vegetabile falitum*).

This neutral falt is fometimes, though rarely, met with on the earth, generated perhaps, as profeffor Bergman obferves, by the deftruction of animal and vegetable fubftances.

According to Macquer, this falt has been very wrongly called *regenerated marine falt*; and the epithet of *febrifuge* has alfo been given to it, without any good reafon, to evince that it has fuch a property. But M. de Morveau calls it *muriate de potaffe* with great propriety.

This falt is produced by a perfect combination of the vegetable alkali with marine acid. It has been wrongly confounded with common falt.—It is found in fome bogs in Picardy, and in fome mineral waters at Normandy, according to Monet, quoted by Kirwan. Mongez adds alfo the fea-water, as containing this falt, and that it is never found in large quantities, although its components parts are abundantly produced by nature. See Chemistry-*Index*, at *Digeftive*.

IV. Mild vegetable alkali, (*alkali vegetabile aeratum.*)

This falt was formerly confidered as a pure alkali, known by the name of *potafh* and *falt of tartar*: but fince the difcovery of the aerial acid, it is very properly claffed among the neutral falts, and ought to be called *aerated potaffe*.

It refults from a combination of the vegetable alkali with the aerial acid, and is hardly ever found native, unlefs in the neighbourhood of woods deftroyed by fire.

On being expofed on a piece of charcoal, urged by the blow-pipe, it melts, and is abforbed by the coal; but,

In the metallic fpoon, it forms a glaffy bead, which becomes opaque when cold.

V. Vitriolated acid faturated with mineral alkali; Glauber's falt. *Alkali minerale vitriolatum*.

This is a neutral falt, prepared by nature (as well as by art), containing more or lefs of iron, or of a calcareous earth; from which arifes alfo fome difference in its effects when internally ufed. It fhoots eafily into prifmatical cryftals, which become larger in proportion to the quantity of water evaporated before the chryftallifation. When laid on a piece of burning charcoal, or elfe burnt with a phlogifton, the vitriolic acid difcovers itfelf by the fmell refembling the hepar fulphuris.

It is found in a diffolved ftate in fprings and wells. Some of the lakes in Siberia and Aftracan,

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penetrating, and fuffocates animals. Its tafte is acrid and cauftic. It quickly converts blue vegetable colours to green, and produces heat during its combination with water. But if the water be frozen, it melts, producing at the fame time an extreme degree of cold. It has a remarkable action on moft metals, particularly copper.

This fubftance is obtained by the putrefactive fermentation from animal and fome vegetable matters. It is this falt which caufes that ftrong fmell which is perceived in drains and privies on a change of weather. (*Mongez.*)

Its volatility arifes from a very fubtile and volatile (or phlogiftic) oil, which enters as a principle into its compofition. (*Macquer.*)

(L) The folution of copper by this alkali, which is of a fine blue, prefents a remarkable phenomenon. For if it be kept in a well clofed phial, the colour decays, and at length difappears, giving place to tranfparency. But on opening the phial, the furface or part in contact with the air becomes blue, and the colour is communicated through the whole mafs. This experiment may be many times repeated with the fame fuccefs.

can, and many ſprings in other places, contain this ſalt, according to Bergman. It is found in the ſea-water; alſo in the earth, at ſeveral parts of Dauphiné in France, and in Lorraine; and ſometimes it germinates on the ſurface of the earth, according to Monet, quoted by Kirwan. It is found, in a dry form, on walls, in ſuch places where aphronitrum has effloreſced through them, and the vitriolic acid has happened to be preſent; for inſtance, where marcaſites are roaſted in the open air. This ſalt is often confounded with the aphronitum or mild mineral alkali.

VI. Cubic or quadrangular nitre. *Alkali minerale nitratum.*

This is the neutral ſalt which reſults from the combination of mineral alkali with nitrous acid. It has almoſt all the characters of priſmatic or common nitre, from which it only differs on account of its baſe; and takes its denomination from the figure of its cryſtals, which appear cubic.

This ſalt rarely occurs but where marine plants putrify. According to Bowles, quoted by Kirwan, it is found native in Spain. See Chemistry, n° 741, &c.

VII. Common ſalt, or ſea-ſalt; *Alkali minerale ſalitum, ſal commune.*

This ſalt ſhoots into cubical cryſtals during the very evaporation; crackles in the fire, and attracts the humidity of the air. It is a perfectly neutral ſalt, compoſed of marine acid, ſaturated with mineral alkali. It has a ſaline but agreeable flavour. See Chemistry-*Index*, at *Sea-ſalt.*

A. Rock ſalt, foſſile ſalt; *Sal montanum.* Occurs in the form of ſolid ſtrata in the earth.

1. With ſcaly and irregular particles.
   - *a.* Grey, and
   - *b.* White. Theſe are the moſt common, but the following are ſcarcer:
   - *c.* Red;
   - *d.* Blue; and
   - *e.* Yellow, from Cracow in Poland, England, Salzberg, and Tirol.
2. Cryſtalliſed rock ſalt; *ſal gemmæ.*
   - *a.* Tranſparent, from Cracow in Poland, and from Tranſylvania.

B. Sea-ſalt.

This is produced alſo from ſea-water, or from the water of ſalt lakes by evaporation in the ſun, or by boiling.

The ſeas contain this ſalt, though more or leſs in different parts. In Siberia and Tartary there are lakes that contain great quantities of it.

C. Spring ſea-ſalt.

This is produced by boiling the water of the fountains near Halle in Germany, and other places.

Near the city of Lidkoping, in the province of Weſtergotland, and in the province of Dal, ſalt-ſprings are found, but they contain very little ſalt: and ſuch weak water is called *ſolen* by the Swedes.

VIII. Borax.

This is a peculiar alkaline ſalt, which is ſuppoſed to belong to the mineral kingdom, and cannot be otherwiſe deſcribed, than that it is . . . . . . diſſoluble in water, and vitreſcible; . . . . . . that it is fixed in the fire; and melts to a glaſs; which glaſs is afterwards diſſoluble in water. See the detached article Borax.

IX. Mild mineral alkali; *Alkali minerale aeratum.* Natron, the nitre of the ancients.

This neutral ſalt is a combination of the mineral alkali with the aerial acid or fixed air. It is found plentifully in many places, particularly in Africa and Aſia, either concreted into cryſtalliſed ſtrata, or fallen to a powder; or effloreſcing on old brick walls; or laſtly, diſſolved in ſprings. It frequently originates from decompoſed common ſalt.

This is an imperfect neutral ſalt, and was formerly conſidered as a pure alkali; but the diſcovery of the aerial acid has ſhown the miſtake.

1. It has nearly all the properties of the *pure* mineral *alkali* N° II. *A.* 1. (p. 90.), but with leſs energy.
2. The vegetable blue colours are turned green by this ſalt; it effloreſces with acids, and has an urinous taſte.
3. It is ſoluble in twice its weight of cold wawater; but if the water is hot, an equal weight is ſufficient for its ſolution.
4. It effloreſces when expoſed to the action of the atmoſphere.
5. It fuſes eaſily on the fire, but without being decompoſed.
6. Facilitates the fuſion of vitrifiable earths, and produces glaſs more or leſs fine according to their qualities.
7. It is decompoſable by lime and ponderous earth, which attract the aerial acid.
8. And alſo by the mineral acids; but theſe expel the aerial acid of this ſalt, by ſeizing its alkaline baſis, (*Mongez.*)

Wallerius confounds this ſalt with the *aphronitrum* after-mentioned, and calls it *halinitrum*, when it contains ſome phlogiſton. Mr Kulbel, quoted by Wallerius, ſhowed that it exiſts in ſome vegetable earths, and takes it to be the cauſe of their fertility; but this (M. Magellan obſerves) can only be on account of its combination with the oily parts of them, and forming a kind of ſoap, which is miſcible with the watery juices.

X. Vitriolic ammoniac, (*Alkali volatile vitriolatum.*)

This neutral ſalt was called *ſecret ſalt of Glauber*, and is a combination of the volatile alkali with vitriolic acid. According to Bergman, it is ſcarcely found any where but in places where the phlogiſticated fumes of vitriolic acid ariſe from burning ſulphur, and are abſorbed in putrid places by the volatile alkali. Thus at Fahlun the acid vapour from the roaſted minerals produces this ſalt in the neceſſary-houſes. Dr Withering, however, obſerves, that as volatile alkali may be obtained in large quantities from pit-coal, and produced by proceſſes not dependent upon putrefaction, there is reaſon to believe that the vitriolic ammoniac may be formed in ſeveral ways not noticed by the above author.

It

Neutral Salts.

It is said to have been found in the neighbourhood of volcanoes, particularly of Mount Vesuvius, where, indeed, it might well be expected; yet its existence seems dubious, since Mr Bergman could scarce find any trace of it among the various specimens of salts from Vesuvius which he examined. The reason (according to M. Magellan) probably is, that the vitriolic acid disengaged by the combustion of sulphur is in a phlogisticated state; and all its combinations in this state are easily decomposed by the marine acid, which plentifully occurs in volcanoes. It is also said to be found in the mineral lakes of Tuscany, which is much more probable, as the vitriolic acid when united to water easily parts with phlogiston, and recovers its superiority over other acids. It is said likewise that this neutral salt is found on the surface of the earth in the neighbourhood of Turin.

1. This salt is of a friable texture, and has an acrid and urinous taste.
2. Attracts the moisture of the atmosphere.
3. Is very soluble in water, it requiring only twice its weight of cold water, or an equal weight of boiling water, to be dissolved.
4. It becomes liquid on a moderate fire; but if urged,
5. It becomes red hot, and volatilizes.
6. The nitrous and muriatic acid decompose this salt by seizing the volatile alkali. But
7. Lime, ponderous earth, and pure fixed alkali, set the volatile alkali free, and combine with the vitriolic acid.
8. According to Kirwan, 100 parts of this salt contain about 42 of real vitriolic acid, 40 of volatile alkali, and 18 of water.

This vitriolic ammoniac is easily known; for if quicklime or fixed alkali be thrown into its solution, the smell of the volatil alkali is perceived; and if this solution be poured into that of chalk or ponderous earth by the nitrous acid, a precipitate will appear.

XI. Nitrous ammoniac, (*Alkali volatile nitratum.*)

This is a neutral salt, which results from the combination of the nitrous acid with the volatile alkali. It is frequently found in the mother-liquor of nitre. When mixed with a fixed alkali, the volatile betrays itself by its smell.

1. It is of a friable texture, of a sharp bitter, and of a nitrous or cooling taste.
2. According to Mongez, it attracts the moisture of the atmosphere; but Romé de l'Isle asserts, that its crystals are not deliquescent: the experiment may be easily tried, and the truth ascertained.
3. It is soluble in cold water; but half the quantity of water, if boiling, is sufficient for dissolving it.
4. It liquefies on the fire, and afterwards it becomes dry.
5. It detonates with a yellow flame before it is red hot; and what is peculiar to this salt, it needs not, like common nitre, the contact of any combustible matter for its detonation; from whence it appears that the volatile alkali itself possess a great share of phlogiston.
6. Its component parts, viz. the nitrous acid and the volatile alkali, are not very intimately united; and of course,
7. It is easily decomposed by all the substances that have any affinity to either of them.
8. Mixed with the muriatic acid it makes aqua regia.
9. One hundred parts of this neutral salt contain 46 of nitrous acid, 40 of volatile alkali, and 14 of water, as Mr Kirwan thinks.

XII. Native sal ammoniac. The muriatic (or marine) acid saturated with a volatile alkali.

This is of a yellowish colour, and is sublimed from the flaming crevices, or fire-springs, at Solfatara, near Naples.

XIII. Aerated or mild volatile alkali.

This neutral salt results from the combination of volatile alkali united to the aerial acid. It was formerly considered as a pure alkali:—But the discovery of the aerial acid (or fixed air) has shown it to be a true neutral salt, though imperfect; as it retains still all the properties of an alkali, though in a weaker degree, on account of its combination with the aerial acid, which is itself the most weak of all acids, and of course other stronger acids easily dislodge it from its base, and from various ammonial salts.

1. This imperfect neutral salt has an urinous taste, and a particular smell, which is very penetrating, though less pungent, than the pure volatile alkali; and in the same manner it turns the blue vegetable juices green. But,
2. It effervesces with other acids stronger than the aerial one, which the pure or caustic volatil alkali does not.
3. It sublimes very easily with a small degree of heat;
4. And dissolves in twice its weight of cold water; but in a lesser quantity, when this last is boiling hot.
5. It acts on metallic substances, chiefly on copper, with which a blue colour is produced.

According to Bergman, this salt was found in a well in London (Phil. Trans. for 1767), at Frankfort on the Mein, and at Lauchstadt.—Messrs. Hierne, Henkel, and Brandt, have found also this salt in the vegetable earth, in various kinds of argil, and in some stony substances. Mr Vozel found it also in some of the incrustations at Gottingen; and Mr Malouin in some acidulous waters of France.

M. Magellan observes, that the borax and the three aerated alkalis are called *imperfect* neutrals; whilst the other neutral salts have acquired the name of *perfect*, because these last do not exhibit any of the distinguishing properties of their component parts. The three aerated alkalis have a very distinct alkaline character, as they turn blue vegetable juices green, though not of so vivid a colour as the caustic alkali

alkali does; and the borax is capable of receiving almoſt an equal quantity of its ſedative acid, without loſing all its alkaline properties.

In general, thoſe neutral ſalts, conſiſting of fixed alkalies combined with acids, are more ſaturated than thoſe compoſed of volatile alkali called ammoniacal ſalts, or thoſe called aerated; which laſt are only compoſed by the combination of the aerial acid, united to any alkaline or earthy baſe.

The aerated alkalis are called alſo by the name of *mild* alkalis, becauſe they poſſeſs no longer that ſharp corroding quality which they exhibit when deprived of the aerial acid or fixed air; in which caſe they are termed cauſtic alkalis.

Theſe aerated alkalis differ alſo from the cauſtic ones, not only on account of the mildneſs of their taſte, from which comes their epithet of mild alkalis, but alſo by their property of cryſtalliſing, and by their effervefcing with other acids, which expel the aerial one, the weakeſt of all acids we know.

Order IV. Earthy *Neutral Salts.*

The compounds of earths and acids which poſſeſs ſolubility are decompoſed and precipitated by mild, but not by phlogiſticated alkalis.

I. Calcareous earth combined with vitriolic acid.—

Vitriolated calx; Selenite; Gypſum. See p. 72. col. 1. *ſupra.*

The gypſum, or plaſter, is not only found diſſolved in various waters, but alſo in many places it forms immenſe ſtrata. It is placed by all mineralogiſts among the earths, which it greatly reſembles; but it rather belongs to the ſaline ſubſtances of the neutral kind, as appears by its conſtituent parts. When burnt, it generates heat with water, but in a leſs degree than lime does. Berg. Sciag. § 59.

This ſalt has a particular taſte, neither bitter nor aſtringent, but earthy, when applied to the tongue; and it is owing to it that ſome waters, chiefly from pumps and wells, are called hard waters, becauſe they lie heavy on the ſtomach.

It is unalterable whilſt kept in a dry place; but on being expoſed to a moiſt air, it is much altered, and ſuffers a kind of decompoſition.

When expoſed to fire ſo as to loſe the water off its cryſtalliſation, it aſſumes a dead white colour; and it is then what we call plaſter of Paris; but if the fire is too ſtrong, it melts and vitrifies, after loſing the vitriolic acid with which it is ſaturated. See Gypsum.

The moſt famous quarries of gypſum in Europe, are thoſe of Montmartre, near Paris. See *Journal de Phyſique*; 1780, vol. xvi. p. 289 and 1782, vol. xix. p. 173.

It is found alſo in the vegetable kingdom.—Mr Model found that the white ſpots in the root of rhubarb are a ſelenitical or gypſeous earth (*Journal de Phyſ.* vol. vi. p. 14.)

What is called foſſil flour (*farine foſſile* in French), generally found in the fiſſures of rock and gypſeous mountains, is very different from the agaricus mineralis p. 71. col. 1. and from the lac lunæ p. 87. col. 1.; as it is a true gypſeous earth, already deſcribed p. 72. col. 1. which, according to Mongez, is of a white and ſhining colour, though ſometimes it aſſumes a reddiſh or blueiſh colour, on account of ſome martial mixture.

II. Nitre of lime, (*Calx nitrata.*)

This earthy ſalt is ſometimes found in water, but very ſparingly. It is ſaid that the chalk hills in ſome parts of France become ſpontaneouſly impregnated with nitrous acid, which may be waſhed out, and after a certain time they will become impregnated with it again. It is a combination of the nitrous acid with calcareous earth. (*Berg. Sciagr.*)

1. It is deliqueſcent; and is ſoluble in twice its weight of cold water, or in an equal weight of boiling water.
2. Its taſte is bitter.
3. Is decompoſed by fixed alkalies, which form the cubic and the priſmatic nitres.
4. But cauſtic volatile alkali cannot decompoſe it.
5. It does not deflagrate in the fire; yet paper moiſtened with a ſaturated ſolution of it crackles in burning.
6. In a ſtrong heat it loſes its acid.
7. Its ſolution does not trouble that of ſilver in nitrous acid.
8. The vitriolic acid precipitates its baſis.
9. As does likewiſe the acid of ſugar.
10. One hundred parts of it contain, when well dried, about 33 of nitrous acid, 32 of calcareous earth, and 35 of water.

It exiſts in old mortar, and in the mother liquor of nitre; and alſo in the chalk rocks near Roche Guyon, in France. (*Kirwan.*)

III. Muriatic chalk, or fixed ſalt ammoniac. *Acidum ſalis communis terra calcarea ſaturatum.*

This ſomewhat deliqueſces, or attracts the humidity of the air. It is found in the ſea water.

It is with great impropriety that this ſalt has obtained the name of ammoniac, on account only of its being formed in the chemical laboratories during the decompoſition of the ammoniacal ſalt with lime, in the proceſs for making the cauſtic volatile alkali. In this caſe, the muriatic acid unites to the calcareous baſis, while this laſt gives its water to the volatile alkali; which, therefore, comes over in a fluid cauſtic ſtate: but if chalk is employed inſtead of lime, the volatile alkali receives the aerial acid inſtead of water, and comes over in a concrete form. In neither caſe, the new combination of calcareous earth with muriatic ſalt has any volatile alkali to deſerve the name of ammoniacal ſalt. (*Macquer.*)

1. This earthy ſalt has a ſaline and very diſagreeable bitter taſte. It is ſuppoſed to be the cauſe of that bitterneſs and nauſeous taſte of ſea-water.
2. It fuſes in the fire, and becomes phoſphoreſcent, after undergoing a ſtrong heat.
3. It becomes hard, ſo as to ſtrike fire with ſteel.
4. It is then the phoſphorus of Homberg.
5. It is decompoſable by ponderous earth and fixed alkalis.

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6. And also by the vitriolic or nitrous acid; which expel the muriatic acid, to unite with the calcareous basis. (*Mongez.*)
7. Its solution renders that of silver in the nitrous acid turbid, at the same time that
8. It makes no change in that of nitrous selenite.
9. It obstinately retains its acid in a red heat.
10. One hundred parts of this earthy salt contain, when well dried, about 42 of marine acid, 38 of calcareous earth, and 20 of water.
11. It is found in mineral waters, and in the salt works at Saltzburg. (*Kirwan.*)

IV. Aerated chalk, (*Calx aerata.*)

Whenever calcareous earth is over saturated with the aerial acid, it becomes a true earthy neutral salt; becomes soluble in water, and has a slight pungent bitter taste. It is commonly found dissolved in waters, in consequence of an excess of the aerial acid. When this greatly abounds, the water is said to be hard (*cruda*). By boiling or by evaporation, it deposits streaks or crusts of calcareous matter.

But when the calcareous earth is only saturated with the aerial acid without excess, it is not easily soluble; it is then the calcareous spar p. 71. col. 2. and is properly referred to the class of earths, p. 71. col. 1.

V. Vitriolated ponderous earth. *Terra ponderosa vitriolata; barytes vitriolata.*

This earthy salt, known by the name of ponderous spar, is a combination of the ponderous earth described in p. 75. col. 1. with the vitriolic acid; and has been already treated of.

The nitrous ponderous earth, according to Bergman, has not yet been found, although it may perhaps exist somewhere, and of course be discovered in nature.

VI. Muriatic barytes, marine baro-selenite. *Barytes salita.*

This earthy salt consists of marine acid united to the ponderous earth. It is said to have been found in some mineral waters in Sweden; and may be known by its easy precipitability with vitriolic acid, and by the great insolubility and weight of this resulting compound, which is the true ponderous spar of the preceding section.

VII. Aerated ponderous earth. *Barytes aerata.*

This earthy neutral salt was found by Dr Withering in a mine at Alstonmore in the county of Cumberland in England. He says that it is very pure, and in a large mass. This substance is a new acquisition to mineralogy, and may be turned to useful purposes in chemistry.

1. It effervesces with acids, and melts with the blow-pipe, though not very readily.
2. In a melting furnace, it gave some signs of fusion; but did not feel caustic when applied to the tongue, nor had it lost its property of effervescing with acids.
3. But the precipitated earth from a saturated solution of it in the marine acid, by the mild vegetable or mineral alkali being burned, and thrown into water, gave it the properties of lime-water, having an acrid taste in a high degree: and a single drop of it added to the solutions of vitriolated salts, as the Glauber's salt, vitriolated tartar, vitriolic ammoniac, alum, Epsom salt, selenite, occasioned immediately a precipitation; from whence it appears to be the nicest test to discover the vitriolic acid. By it the marine acid may also be easily freed from any mixture of vitriolic acid, by means of this calx of ponderous earth. See Chemistry, n° 1049. *et seq.*

VIII. Vitriolated magnesia.

This earthy neutral salt is called by the English *Epsom salt; Sel d'Angleterre* by the French, and also *sel de Sedlitz*, *de Seydschutz*, *sel amer*, *sel cathartique amer*, &c. These various names are given to it, either on account of its properties, it being a very mild purgative; or from the places where it is found, besides many others, as in the waters of Egra, of Creutzbourg, Obernental, Umea, &c. It has also been found native, mixed with common salt and coaly matter, germinating on some free stones in coal mines. See *Kirwan's Mineralogy*, p. 183.

1. It has a very bitter taste.
2. It is soluble in one part and a half of its weight of cold water: but in hot water, a given weight of it dissolves the double of this salt.
3. It effloresces when exposed to a dry atmosphere, and is reduced to a white powder.
4. Exposed to the fire, it loses the water of its crystallisation, and is reduced into a friable mass.
5. This earthy salt is decomposed by fixed and volatile alkalies.
6. Lime-water precipitates the magnesia from its solution, the calcareous earth of lime-water combining itself with the vitriolic acid, and forming a selenite. *N. B.* By this test the vitriolated magnesia is easily distinguished from the vitriolated mineral alkali or Glauber's salt which it resembles.
7. But crude chalk, or aerated calcareous earth, has not such an effect in the same case; which shows how much the efficacy of this substance, viz. the calcareous earth, is diminished merely by its union with the aerial acid.
8. When urged by the flame with the blow-pipe, it froths; and may be melted by being repeatedly urged with that instrument.
9. With borax it effervesces, and also when burned with the microcosmic salt.
10. According to Bergman, 100 weight of this salt contains only 19 parts of pure magnesia, 33 of vitriolic acid: and 48 of water. But
11. According to Kirwan, 100 parts of it contain about 24 of real vitriolic acid, 19 of magnesian earth, and 57 of water.

IX. Nitrated magnesia; nitrous Epsom salt.

This earthy salt is usually found together with nitre. It is a combination of the nitrous acid with the magnesian earth.

1. It has an acrid taste, very bitter.
2. Attracts the moisture from the atmosphere, and deliquesces.
3. Is very soluble in water.

4. Is

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4. Is eafily decompofable by fire.
5. The ponderous and calcareous earths decompofe it, and alfo the alkalies.
6. On being urged by the blow-pipe, it fwells up with fome noife, but does not detonate.
7. If faturated folutions of nitrous felenite and of this falt be mixed, a precipitate will appear; but,
8. Neither vitriolic acid, nor mild magnefia, will occafion any turbidnefs in its folution.
9. One hundred parts of this falt contain about 36 of real nitrous acid, 27 of magnefian earth, and 37 of water.

It exifts in old mortar, and is found alfo in the mother liquor of nitre. As lime-water decompofes it, M. de Morveau has indicated the ufe of this procefs, not only to complete its analyfis; but alfo to feparate, in large quantities, and at a very cheap rate, the magnefian from the calcareous earth, as M. Mongez relates upon this fubject.

X. Muriatic magnefia. *Magnefia falita.*

This earthy falt is a combination of magnefian earth with the muriatic acid. According to Bergman, it is found in the fea in greater plenty than any other falt except the fea-falt.

1. It has a very bitter tafte: and being always mixed in the fea-water, it is the principal caufe of its bitternefs.
2. It is very deliquefcent, and foluble in a fmall quantity of water.
3. All the alkalies, even the cauftic volatile alkali and lime, decompofe it by precipitating its bafis.
4. The vitriolic, nitrous, and boracic acids expel the muriatic acid from the bafe of this neutral falt.
5. Its folution does not trouble that of nitrous or marine felenite; but,
6. It caufes a cloud in the nitrous folution of filver.
7. The vitriolic acid throws down no vifible precipitate from the folution of this neutral falt.
8. It lofes its acid in a red heat.

XI. Aerated magnefia.

Common magnefia, with an excefs of aerial acid, is a true neutral falt, like the aerated felenite of p. 96. col. 1. and becomes foluble in cold water. Otherwife it is fcarce foluble at all; and is then claffed among the earths.

This neutral falt is decompofable by fire, by which its water and its acid are expelled; and it may become phofphoric.

When urged by fire, it agglutinates a little: and fome pretended that it melts. But it muft be in an impure ftate to vitrify at all.

The three mineral acids, and the alkalies, diffolve this falt with effervefcence, by expelling the aerial acid.

XII. Argillaceous earth combined with vitriolic acid. The *alum* kind. See Alum, and Chemistry-*Index*.

a. With a fmall quantity of clay; native or plumofe alum.

It is found on decayed alum ores in very fmall quantities; and therefore, through ignorance, the alabaftrites and felenites, both of which are found among moft of the alum flates, are often fubftituted in its ftead, as is alfo fometimes the afbeftus, notwithftanding the great difference there is between the alum and thefe both in regard to their ufes and effects.

b. With a greater quantity of pure clay; white alum ore.

1. Indurated pale-red alum ore, (*fchiftus aluminis Romanus*.) It is employed at Lumini, not far from Civita Vecchia in Italy, to make the pale-red alum called *roch alum*. This is, of all alum ores, the moft free from iron; and the reddifh earth which can be precipitated from it, does not fhow the leaft marks of any metallic fubftance.

c. With a very large quantity of martial clay, which likewife contains an inflammable fubftance: Common alum ore. This is commonly indurated and flaty, and is therefore generally called *alum flate*.

It is found,

1. With parallel plates, having a dull furface; from Andrarum in the province of Skone, Hunneberg and Billingen in the province of Weftergottland, Rodoen in the province of Jemtland, and the ifland of Oeland, &c. In England, the great alum works at Whitby in Yorkfhire are of this kind.
2. Undulated and wedge-like, with a fhining furface. This at the firft fight refembles pitcoal; it is found in great abundance in the parifh of Nas in Jemtland.

XIII. Argillaceous earth faturated with muriatic acid. *Argilla falita*.

Profeffor Bergman fays, that the combinations of the argillaceous earth with the nitrous, muriatic, and aerial acids, had not yet been found naturally formed as far as he knew. But Dr Withering affirms, that he found the muriatic argil to exift in a confiderable quantity, in the Nevil Holt water, when he analyfed that mineral water about the year 1777: and he adds, that it is probably contained alfo in the Ballycaftle water in Ireland.

XIV. Argillaceous earth mixed with volatile alkali.

[Although this mixture is by no means a neutral falt, this feems to be the place to treat of it according to the order of faline fubftances adopted in this article.]

The greateft part of the clays contain a volatile alkali, which difcovers itfelf in the diftillation of the fpirit of fea-falt. &c.

Order V. Metallic Salts.

The native falts belonging to this divifion may be diftinguifhed by the phlogifticated alkali, which precipitates them all. The few which have faline properties, according to the definition of falts formerly given, fhall be mentioned here; referring the reft to the mineralifed metals; as the *luna cornea*, the faline quickfilver or muriatic mercury, &c.

Metallic Neutral SALTS.

I. Vitriol of copper; blue vitriol. *Vitriolum veneris, seu cyprium.*

This neutral metallic falt is a combination of the vitriolic acid with copper, and is found in all *ziment waters*, as they are called. Its colour is a deep blue; and being long expofed to the air, it degenerates into a rufty yellow blue. Urged by the flame of the blow-pipe on a piece of charcoal, it froths at firft with noife, giving a green flame, and the metallic particles are often reduced to a fhining globule of copper, leaving an irregularly figured fcoria. But with borax the fcoria is diffolved, and forms a green glafs.

This falt rarely occurs cryftallifed: but is often found naturally diffolved in water in Hungary, Sweden, and Ireland: from this water a blue vitriol is generally prepared. Thefe natural waters are called *cementatory* or *cementing* ones. According to Monet, this concrete falt, when found naturally formed, only proceeds from the evaporation of fuch waters. It is alfo occafionally extracted from fulphurated copper ores after torrefaction. See CHEMISTRY-*Index*, at *Vitriol.*

II. Muriatic copper, or marine falt of copper. *Cuprum falitum.*

This falt has been found in Saxony, in the mine of Johngeorgenftadt. 1. It is of a greenifh colour, and foliated texture. 2. It is moderately hard. 3. Sometimes it is tranfparent and cryftallifed.

It has been taken for a kind of mica: but Profeffor Bergman found it to confift of copper and marine acid, with a little argillaceous earth.

Another fpecimen of a purer fort was depofited in the mufeum of Upfal. This is of a bluifh green colour, and friable. It effervefced with nitrous acid, to which it gave a green colour: and by adding a proper folution of filver, a *luna cornea* was formed, by which the prefence of the muriatic acid was afcertained. (*Kirwan* and *Bergman*)

III. Martial vitriol; vitriol of iron. Common green vitriol or copperas.

This is the common green vitriol, which is naturally found diffolved in water, and is produced in abundance by decayed or calcined marcafites.

This metallic neutral falt refults from the combination of the vitriolic acid with iron.

1. It is of a greenifh colour when perfectly and recently cryftallifed; but,
2. Efflorefces by being expofed to the air, becomes yellowifh, and is covered with a kind of ruft. Sometimes it becomes white by long ftanding.
3. It requires fix times its weight of water, in the temperature of 60 degrees, to be diffolved.
4. It has an aftringent, harfh, and acidulous tafte.
5. Expofed to a moderate heat, even to that of the funfhine, it falls into a yellowifh powder: but,
6. On being expofed to a fudden heat, it melts; and on cooling, affumes a whitifh brown colour.
7. When ftrongly urged by fire, it lofes its acid, becomes of a dark red colour, and is then called *colcothar;* a powder which is employed in polifhing metals, and to which our artifts have applied the improper name of *crocus martis*, though this name only belongs to the yellow preparations of the iron-calces, ufed in pharmacy and in enamelling, &c.
8. Pure fixed alkali precipitates the iron from its folution in deep green flakes; the mild alkali, in a greenifh white colour; pure volatile alkali, in fo deep a green, that it appears black; but the mild volatile alkali precipitates it in a greyifh-green colour.
9. All vegetable aftringents, as the tincture of tea, quinquina, gales, &c. precipitate the iron in a black colour: hence they are ufed as tefts to difcover its prefence in chemical analyfes; and it is from this black precipitate that the common writing ink is made, being diluted in water, and there fufpended by the Arabic or Senegal gums.
10. One hundred parts of this falt, recently cryftallifed, contain 20 of real vitriolic acid, 25 of iron, and 55 of water.
11. Its acid is known by this, that its folution mixes without turbidity with the folutions of other falts that contain vitriolic acid; as Epfom, felenite, vitriolated tartar, &c.
12. And the bafis of this metallic falt is known by the black colour produced by the folution of vegetable aftringents.
13. On being urged by the flame thrown by the blow-pipe, it offers the fame phenomena as the vitriol of copper, except that it does not colour the flame.

Green vitriol is frequently found native, either in coal mines or in the cavities of pyritaceous mines, or adhering to their fcaffolds in a ftalactitical form. It is found alfo in fmall round ftones, called *ink-ftones*, of a white, red, grey, yellow, or black colour, which are almoft foluble in water, and contain a portion of copper and zinc. Alfo fometimes in form of fchiftus or flaty pyritaceous ftones. But the greateft part of that in ufe is prepared by art, from the martial pyrites or mundic. See CHEMISTRY, n° 619.

IV. Aerated iron. *Ferrum aeratum.*

This metallic falt is a combination of the aerial acid with iron; and is found in the light chalybeate waters, where it is diffolved by an excefs of this acid.

Mr Lane was the firft who difcovered in England the action of the aerial acid on iron, when the water is impregnated with that menftruum. The late M. Rouelle demonftrated the fame phenomenon in France upon this and other metals. But Profeffor Bergman feems to have preceded them both nearly about the fame time, though neither had any knowledge of each other's difcoveries.

The great volatility of this acid is the caufe why this neutral falt is not often found. For the mere evaporation of the ferruginous mineral waters, in order to analyfe them, is fufficient to let loofe the aerial acid; fo that the iron which was there diffolved by its power falls down to the bottom in the form of a light ore, which amounts to nearly $\frac{1}{10000}$ of the weight of the water; and when

Metallic Neutral Salts.

when fresh retains so much phlogiston as to obey the magnet, as Bergman says.

V. Vitriol of cobalt, or vitriolated cobalt.

This metallic salt results from the combination of the vitriolic acid with cobalt.

1. When found native, it is always in an efflorescent state; whence it arises that, in this case,
2. Its colour is greenish, mixed with a grey tint: but,
3. It is of a rosy colour when artificially made;
4. Effloresces when exposed to the action of the atmosphere; and,
5. Takes then a greenish colour mixed with a pale purple, or a *Lilias colour*, as the French call it.
6. It is difficultly soluble in water; and,
7. Its solution is of a red colour.
8. The phlogisticated alkali precipitates the cobalt from the solution of this salt, which with borax gives an azure glass.

By the above qualities, chiefly the rosy colour of the solution of this neutral salt, its basis is sufficiently distinguished. As to its acid, it is easily known by the same tests as those of the preceding vitriols.

It is said to be found native in small pieces, mixed with a greenish efflorescence in cobalt mines. (*Kirvan* and *Mongez.*)

VI. Vitriol of zinc, vitriolated zinc, or white vitriol.

This neutral metallic salt results from the combination of vitriolic acid with zinc.

1. Its colour is white. It,
2. Requires little more than twice its weight of water to dissolve it in the temperature of 60 degrees of Fahrenheit's thermometer, and deposits a greyish yellow powder.
3. Its specific gravity is 2000.
4. Its taste is very styptic.
5. It mixes uniformly with vitriolic neutral salts.
6. Precipitates nitrous or marine selenites from their solutions, by which its acid is ascertained.
7. It is precipitable in a whitish powder by alkalies and earths; but,
8. Neither iron, copper, nor zinc, precipitate it: by which circumstance its basis is sufficiently indicated.
9. If it contains any other metallic principle, this may be precipitated by adding more zinc to the solution; excepting iron, which will of itself precipitate by exposure to the air or boiling in an open vessel.
10. One hundred parts of this metallic salt contain 22 of vitriolic acid, 20 of zinc, and 58 of water.
11. Urged by fire, it loses a good part of its acid.
12. Treated with the blow-pipe, it exhibits nearly the same phenomena as other metallic vitriols; except only that the flame is brilliant when the zinc is reduced, and gives out white flocs called *flowers of zinc*

This neutral metallic salt is sometimes found native, mixed with vitriol of iron, and in the form of white hairy crystals; or in a stalactitical form in the mines of Hungary, or as an efflorescence on ores of zinc. It is also found dissolved in mineral waters, and generally with some proportion of vitriols of iron and copper. Bergman says, it is sometimes produced by the decomposition of pseudogalæna, or black-jack; but this rarely happens, because this substance does not readily decompose spontaneously.

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But that in common use is mostly prepared at Goslaar, from an ore which contains zinc, copper, and lead, mineralised by sulphur and a little iron. The copper is first separated as much as possible: the remainder after torrefaction and distillation is thrown red-hot into water and lixiviated. It is never free from iron. (*Kirwan*, *Mongez.*)

VII. Vitriolated nickel, or vitriol of nickel

This neutral metallic salt results from the combination of the vitriolic acid with nickel. It exists sometimes in consequence of the decomposition of the sulphureous ores of this semimetal. It is found native, efflorescing on Kupfer-nickel; and generally mixed with vitriol of iron.—It is of a green colour, as well as its solution. It is precipitated by zinc; but when joined with iron, this last is not precipitated by the same.

Its origin is perhaps owing to the decomposition of the pyritaceous and sulphureous ore of Kupfer-nickel, mentioned by Wallerius. This ore contains a great quantity of arsenic and sulphur, as well as cobalt, nickel, and iron. And if it comes to be decomposed in the bowels of the earth, it is natural to expect that the vitriolic acid of the sulphur will attack the nickel and the iron, with which it will form neutral metallic salts (*Mongez*, *Kirwan*).

VIII. Muriatic manganese. *Manganesium salitum.*

M. Hielm is the only person who has as yet found this middle salt in some mineral waters of Sweden. It is composed by the combination of the regulus of Manganese with muriatic acid.

1. It is precipitated of a whitish yellow colour, by the Prussian (phlogisticated) alkali; and of a brownish yellow, by the mineral alkali. 2. It does not crystallise in any distinct form. 3. It abstracts the moisture of the air. 4. To obtain its basis free from iron, it must be precipitated by the mineral alkali; redissolved in nitrous acid; then calcined until this acid is expelled; and the residuum is to be treated with distilled vinegar, which will then take up only the manganese. (*Kirwan.*)

Order VI. Triple Salts.

The neutral salts hitherto enumerated are such as are composed of two ingredients only; but sometimes three or more are so united as not to be separated by crystallization. The vitriols that we are acquainted with are hardly ever pure; and two or three of them sometimes are joined together.

Sometimes likewise it happens that neutral salts join earthy salts, and earthy salts metallic ones. Bergman generally distinguishes compound salts according to the

Triple Neutral Salts.

the number of their principles, whether the ſame acid be joined to ſeveral baſes, or the ſame baſe to different acids; or, laſtly, whether ſeveral menſtrua and ſeveral baſes are joined together. Hence ariſe ſalts triple, quadruple, &c. which the diligence of aftertimes muſt illuſtrate. The moſt remarkable examples of triple and quadruple native ſalts which have yet occurred are,

I. Mineral alkali, with a ſmall quantity of calcareous earth. *Alkali ſalis communis*. Aphronitrum.

This is ſo ſtrongly united with the calcareous earth, that the latter enters with it into the very cryſtals of the ſalt: though by repeated ſolutions the earth is by degrees ſeparated from it, and falls to the bottom after every ſolution.

It grows in form of white froſt on walls, and under vaults; and in places where it cannot be waſhed away by the rain.

Hence it would appear, that this is not only a *triple*, but a *multiple* ſalt; as theſe pieces of old mortar covered with this white froſt, on ancient walls, are the very ſame from which the ſaltpetre makers extract the mother-water of nitre, after mixing therewith the vegetable aſhes, to furniſh the alkaline baſe to it. M. Fourcroy ſays in his ſeventeenth Lecture, that this mother-water contains not only nitre, but five other kinds of ſalt, viz. the *marine ſalt*, *nitrous magneſia*, *calcareous nitre*, *magneſia nitrata*, and *calx ſalita*; to which the chemiſts of Dijon add the *digeſtive ſalt of Sylvius*, and in ſome caſes various *vitriols* with *alkaline* or *earthy baſes*.

When it contains any conſiderable quantity of the calcareous earth, its cryſtals become rhomboidal, a figure which the calcareous earth often aſſumes in ſhooting into cryſtals: but when it is purer, the cryſtals ſhoot into a priſmatic figure.

This is a circumſtance which neceſſarily muſt confuſe thoſe who know the ſalts only by their figure; and ſhows, at the ſame time, how little certainty ſuch external marks afford in a true diſtinction of things.

This ſalt is very often confounded with the *ſal mirabile Glauberi*.

II. Common ſalt with magneſia; or muriatic mineral alkali contaminated by muriatic magneſia.

This is a compound of the common ſalt with muriatic magneſia: and by the expreſſion *contaminated (inquinatum)* of profeſſor Bergman, we may ſuppoſe that the magneſian ſalt is not intimately united to the alkaline baſe.

This triple ſalt is very deliqueſcent; a quality it owes to its integrant part the muriatic magneſia, (p. 97. col. 1.) For the pure muriatic alkali does not deliqueſce: but this degree of purity is ſeldom found, even in the native foſſil or *ſal gem*, (p. 93. col. 2.) In general all the earthy marine ſalts are very deliqueſcent, as the muriatic chalk, the muriatic barytes, and the muriatic magneſia. *Bergman*, *Macquer*, and *Mongez*.

III. Mineral alkali with ſuccinous acid and phlogiſton.

This ſubſtance will be afterwards mentioned among the *inflammables*.

IV. Vitriolated magneſia with vitriol of iron. Epſom ſalt contaminated with copperas.

Found in ſome mineral waters, according to Mr Monet, (*Treatiſe on Mineral Waters*).

V. Native-alum contaminated by copperas. Vitriolated argil with vitriol of iron.

Found in the aluminous ſchiſtus. It ſometimes efloreſces in a feathery form. Perhaps this is the *plumoſe alum* of the ancients.

VI. Native alum, contaminated by ſulphur.

At the places about Wedneſbury and Bilſton, in Staffordſhire, where the coal pits are on fire, this ſubſtance ſublimes to the ſurface; and may be collected, in conſiderable quantity, during dry or froſty weather.

A ſimilar compound ſubſtance ſublimes at the Solfaterra near Naples.

VII. Native alum contaminated by vitriolated cobalt.

In the mines of Herregrund and Idria this ſalt may be ſeen ſhooting out into long ſlender filaments. Perhaps this is the *trichites* of the Greeks.

1. Diſſolved in water, it immediately betrays the preſence of vitriolic acid upon the addition of terra poderoſa ſalita (muriatic acid ſaturated with heavy earth).
2. By the addition of phlogiſticated alkali, a precipitate of cobalt is thrown down, which makes blue glaſs with borax or microcoſmic ſalt. (*Berg. Sciag.*)

VIII. Vitriol of copper with iron.

This ſalt is of a bluiſh-green colour. It is the *vitriolum ferreo-cupreum cyaneum* of Linnæus. Its colour varies, being ſometimes more or leſs green, and ſometimes more or leſs blue. It is found at Saltzberg and at Falhun. This vitriol is called *vitriol of Hungary*, becauſe it is found in the Hungarian mines is of this kind. (*Mongez.*)

IX. Vitriol of copper, iron, and zinc.

This is the *vitriolum ferreo-zinceo-cupreum cyaneum* of Linnæus. Its colour is of a blue inclining to green. If rubbed on a poliſhed ſurface of iron, the copper is not precipitated thereby, as it happens to the blue vitriol; which ſhows that the vitriolic acid is perfectly ſaturated in this ſalt by the three metallic baſes.

X. Vitriol of copper and zinc.

This is the blue vitriol from Goſlar. According to Mongez it is the *vitriolum zinceo-cupreum cæruleum* of Linnæus.

XI. Vitriol of iron and zinc.

This is the green vitriol from Goſlar in the Hartz. According to Mongez, this is the *vitriolum zinceo-ferreum viride* of Linnæus, 105. 6. Its colour is a pale-green caſt.

XII. Vitriol of iron and nickel.

This ſalt is of a deep-green colour, and is contained in the ochre, or decayed parts, of the nickel, at the cobalt-mines of Los, in the province of Helſingland.

Class III. Mineral INFLAMMABLE Substances.

To this claſs belong all thoſe ſubterraneous bodies that are diſſoluble in oils, but not in water, which they

Inflammables.

repel; that catch flame in the fire; and that are electrical.

It is difficult to determine what constitutes the difference between the purer sorts of this class, since they all must be tried by fire, in which they all yield the same product; but those which in the fire show their differences by containing different substances, are here considered as being mixed with heterogeneous bodies: that small quantity of earthy substance, which all phlogista leave behind in the fire, is, however, not attended to.

I. Inflammable air; fire damp.

This aeriform substance is easily known by its property of inflaming when mixed with twice or thrice its bulk of common atmospheric air; and it is asserted to be the real phlogiston almost pure. See AEROLOGY-*Index*, and *INFLAMMABLE Air*.

It admits considerable varieties, acording to the nature of the substances from which it is produced, and often gives different residuums upon combustion, some of which are of the acid kind. If it is produced from charcoal, it yields aerial acid or fixed air: from solutions of metallic substances in the vitriolic, nitrous, or marine acids, it yields these respective acids, as M. Lavoisier asserts.

Æther, converted into vapour in a vacuum, gives a permanent elastic vapour, which is inflammable. The atmosphere, which floats round the fraxinella, is inflammable from the admixture of its vapours, which seem to be of the nature of an essential oil: so that on approaching the flame of a candle under this plant, in hot weather, it takes fire in an instant; although the essential oil, extracted from this plant by distillation, is not inflammable on account of the watery particles mixed with it, as M. Bomare asserts.

Mr Scheele is of opinion, that every inflammable air is composed of a very subtile oil. This coincides with the idea entertained by chemists of their phlogiston; and is confirmed by the fact, of its being naturally found in those springs from whence issues petrol, whose exhalations are very inflammable.

The residuum, which remains in the atmosphere after the combustion of inflammable air, is extremely noxious to animals. Doctor Priestley takes it to be a combination of phlogiston with pure air, and on this account calls it *phlogisticated air*. But M. Lavoisier, on the contrary, considers it to be a primitive substance of an unchangeable nature, and gives it the singular name of *atmospheric mephitis*.

II. Hepatic air.

This air seems to consist of sulphur, held in solution in vitriolic or marine air. It is inflammable when mixed with three quarters of its bulk of common air. Nitre will take up about half the bulk of this air; and when saturated with it, will turn silver black: but if strong dephlogisticated nitrous acid be dropped into this water, the sulphur will be precipitated.

One hundred cubic inches of this air may hold eight grains of sulphur in solution in the temperature of 60°; and more, if hotter.

Atmospheric air also decomposes hepatic air.

It is found in many mineral waters, and particularly in the hot baths of Aix-la-Chapelle. The cause and manner of their containing sulphur, which was long a problem, has at last been happily explained by Mr Bergman.

It plentifully occurs in the neighbourhood of volcanoes and in several mines.

Hepatic air is easily obtained by art, from all sorts of liver of sulphur, whether the base be an alkali, an earth, or a metal, if any acid is poured upon it; and the better, if use be made of the marine acid, because it contains phlogiston enough, and does not so strongly attract that of the *hepar sulphuris*. For this reason the nitrous acid is not fit for this process, as it combines itself with the phlogiston, and produces nitrous air. It may also be produced, by distilling a mixture of sulphur and powdered charcoal, or of sulphur and oil, &c. See the detatched article *HEPATIC Air*, and AEROLOGY-*Index*.

III. Phlogiston combined with aerial acid; black lead, or wadd. *Plumbago*. See the detached article *Black-LEAD*.

It is found,

a. Of a steel-grained and dull texture. It is naturally black, but when rubbed it gives a dark lead colour.

b. Of a fine scaly and coarse-grained texture; coarse black-lead.

IV. Mineral tallow. *Serum minerale*.

This was found in the sea on the coasts of Finland in the year 1736. Its specific gravity is 0.770; whereas that of tallow is 0.969. It burns with a blue flame, and a smell of grease, leaving a black viscid matter, which is with more difficulty consumed.

It is soluble in spirit of wine only when tartarised: and even then leaves an insoluble residuum; but expressed oils dissolve it when boiling.

It is also found in some rocky parts of Persia, but seems mixed with petrol, and is there called *schebennaad*, *tsienpen*, *kodreti*.

Dr Herman of Strasburg mentions a spring in the neighbourhood of that city, which contains a substance of this sort diffused through it, which separates on ebullition, and may then be collected. *(Kirwan)*.

V. Ambergris. *Ambra grisea*.

It is commonly supposed to belong to the mineral kingdom, although it is said to have doubtful marks of its origin (A).

a. It

(A) Ambergris, according to the assertion of M. Aublet (in his *Histoire de la Guiane*), is nothing more than the juice of a tree inspissated by evaporation into a concrete form. This tree grows in Guyana, and is called

Inflammables.

a. It has an agreeable ſmell, chiefly when burnt:

b. Is conſumed in an open fire:

c. Softens in a ſlight degree of warmth, ſo as to ſtick to the teeth like pitch.

d. It is of a black or grey colour; and of a dull or fine grained texture (B).

The grey is reckoned the beſt, and is ſold very dear. This drug is brought to Europe from the Indies. It is employed in medicine; and alſo as a perfume (C).

VI. Amber. *Ambra flava, ſuccinum, electrum,* Lat. *Carabé,* French. *Agtſtein, Bernſtein,* Germ.

This ſubſtance is dug out of the earth, and found on the ſea-coaſts. According to the experiments of M. Bourdelin, it conſiſts of an inflammable ſubſtance, united with the acid of common ſalt, which ſeems to have given it its hardneſs.

It is ſuppoſed to be of vegetable origin, ſince it is ſaid to be found together with wood in the earth.

By diſtillation it yields water, oil, and a volatile acid ſalt, which the above mentioned author has thought to be the acid of common ſalt united with a ſmall portion of phlogiſton.

Inſects, fiſh, and vegetables, are often found included in it, which teſtify its having once been liquid.

It is more tranſparent than moſt of the other bitumens; and is doubtleſs the ſubſtance which firſt gave riſe to *electrical experiments* (on account of the power it poſſeſſes of attracting little bits of ſtraw, or of other light ſubſtances, when rubbed).

Its varieties are reckoned from its colour and tranſparency. It is found,

A.

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called *cuma*, but has not been inveſtigated by other botaniſts. When ſome branches are broken by high winds, a large quantity of the juice comes out; and if it chances to have time to dry, various maſſes (ſome of which had been ſo large as to weigh 1200 pounds and more) are carried into the rivers by heavy rains, and through them into the ſea: afterwards they are either thrown into the ſhore or eaten by ſome fiſh, chiefly the ſpermaceti whale, known by the name of *Phyſeter-macrocephalus* among ichthyologiſts. This kind of whale is very greedy of this gum-reſin, and ſwallows ſuch large quantities when they meet with it, that they generally become ſick; ſo that thoſe employed in the fiſhery of theſe whales, always expect to find ſome amber mixed with the excrements and remains of other food in the bowels of thoſe whales who are lean. Various authors, among whom is Father Santos in his *Ethiopia Orientalis,* who travelled to various places of the African coaſt, and Bomare, ſay, that ſome ſpecies of birds are fond of eating this ſubſtance as well as the whales and other fiſhes. This accounts very well for the claws, beaks, bones, and feathers of birds, parts of vegetables, ſhells, and bones of fiſh, and particularly for the beaks of the cuttle fiſh or *ſepia octopedia,* that are ſometimes found in the maſs of this ſubſtance. Dr Swediar, however, attended only to theſe laſt, though he had mentioned alſo the other ſubſtances in his paper inſerted in the Philoſophical Tranſactions for 1783; wherein he attempts to eſtabliſh an opinion, that the amber is nothing elſe but a preternaturally hardened dung, or feces, of the phyſeter whale. Dr Withering and Mr Kirwan have embraced this notion; as did alſo, inadvertently, the editors of this Work. See AMBERGRIS.

(B) Mr Aublet brought ſpecimens of this gum-reſin, which he collected on the ſpot, from the cuma tree at Guiane. It is of a whitiſh-brown colour with a yellowiſh ſhade, and melts and burns like wax on the fire. The ſingularity of this gum-reſin is, that it imbibes very ſtrongly the ſmell of the aromatic ſubſtances which ſurround it; and it is well known that perfumers avail themſelves very conſiderably of this advantage. M. Rouelle examined very carefully this ſubſtance brought over by Mr Aublet, and found that it produced the very ſame reſults as in other good kind of amber. Beſides Mr Aublet's authority, which is deciſive, as being grounded upon direct proofs of fact, Rumphius, quoted by Bergman, long ſince mentioned a tree called *Nanarium,* whoſe inſpiſſated juice reſembles amber. It cannot therefore at preſent be doubted that the origin of this phlogiſtic ſubſtance is the vegetable kingdom, although it may be often found and reputed as a product of the foſſile kind.

This ſuſtance being analyſed by Meſſrs Geoffroy and Newman, quoted by M. Fourcroy, yielded them the ſame principles as the bitumens; viz. an acid ſpirit, a concrete acid ſalt, ſome oil, and a charry reſiduum; which evidently evinces, that all theſe fat and oily foſſile ſubſtances have their origin from the other two kingdoms of nature.

(C) Ambergris is not only brought from the Eaſt Indies, but from the coaſts of the Bahama Iſlands, Braſil, Madagaſcar, Africa, China, Japan, the Molucca iſlands, the coaſts of Coromandel, Sumatra, &c. Dr Lippert, in a treatiſe he publiſhed at Vienna in 1782, entitled *Phlogiſtologia Mineralis,* has copied chiefly from Wallerius what he aſſerts of this ſubſtance. He affirms that there are eight known ſpecies of amber; five of a ſingle colour, viz. the white and the black from the iſland of Nicobar, in the gulph of Bengal, the aſh-coloured, the yellow, and the blackiſh; and two variegated, viz. the grey coloured with black ſpecks, and the grey with yellow ſpecks. This laſt he aſſerts to be the moſt eſteemed on account of its very fragrant ſmell, and to come from the South coaſt of Africa and Madagaſcar, as well as from Sumatra; and that the black dark coloured amber is often found in the bowels of the cetaceous fiſhes. The ſame author adds alſo from Wallerius, that by diſtilling the oil of yellow amber (*ſuccinum*) with three parts and a half of fuming nitrous acid, a reſiduum remains like roſin, which emits a perfect ſmell of muſk; whence ſome conclude, that the ambergris belongs to the foſſile kind: the contrary, however, is evinced in the preceding note.

Inflam-mables.

A. Opaque.
 a. Brown.
 b. White.
 c. Blackiſh.
B. Tranſparent.
 a. Colourleſs.
 b. Yellow.

The greateſt quantity of European amber is found in Pruſſia; but it is, beſides, collected on the ſea-coaſt of the province of Skone, and at Biorko; in the lake Malaren in the province of Upland; as alſo in France and in Siberia. It is chiefly employed in medicine and for making varniſhes (D).

VII. Rock-oil.

This is an inflammable mineral ſubſtance, or a thin bitumen, of a light brown colour, which cannot be decompoſed; but is often rendered impure by heterogeneous admixtures. By length of time it hardens in the open air, and then reſembles a vegetable reſin; in this ſtate it is of a black colour, whether pure or mixed with other bodies. It is found,

A. Liquid.

1. Naphtha.

This is of a very fragrant ſmell, tranſparent, extremely inflammable, and attracts gold. It is collected on the ſurface of the water in ſome wells in Perſia. See NAPHTHA.

2. Petrol.

This ſmells like the oil of amber, though more agreeable; and likewiſe very readily takes fire. It is collected in the ſame manner as the Naphtha from ſome wells in Italy. See PETROLEUM.

B. Thick and pitchy; *Petroleum tenax.* Barbadoes-tar.

This reſembles ſoft pitch.

It is found at the Dead Sea in the Holy Land; in Perſia, in the chinks of rocks, and in ſtrata of gypſum and limeſtone, or floating on water; alſo in Siberia, Germany, and Switzerland, in coal-pits; and in America: likewiſe in Colebrookdale in England.

C. Elaſtic petrol.

This is a very ſingular foſſil, found of late in England.

By its colour and conſiſtency, it exactly reſembles the Indian-rubber, or the gum-reſin, from the north part of Braſil, called *caoutchouc.* It is of a dark brown colour, almoſt black; and ſome is found of a yellowiſh brown caſt, like the ſame gum-reſin.

With reſpect to its elaſtic conſiſtence, it hardly can be diſtinguiſhed from it, except in the cohefion of its particles, which is weaker.

It has the ſame property of rubbing off from paper the traces of black-lead pencils.

It burns likewiſe with a ſmoky flame; and alſo melts into a thick oily fluid; but emits a diſagreeable ſmell, like the foſſile pitch, or Barbadoes tar.

It

Inflam-mables.

(D) Amber, ſays M. Fourcroy, is found in ſmall detached pieces, for the moſt part under coloured ſands, diſperſed in beds of pyritaceous earth; and above it is found wood, charged with a blackiſh bituminous matter. Hence it is ſtrongly ſuppoſed that it is a reſinous ſubſtance, which has been altered by the vitriolic acid of the pyrites, notwithſtanding that we know that acids, when concentrated, always blacken and charry reſinous ſubſtances. In fact, the chemical analyſis of this ſubſtance rather confirms that ſuppoſition.

The ſingular opinion of Dr Girtanner, about the yellow amber being produced by a kind of ants, may be ſeen in *Journal de Phyſique* for March 1786, page 227. Or ſee the article AMBER in this Dictionary.

The colour, texture, tranſparency, and opacity of this ſubſtance, have ſhown ſome other varieties beſides theſe mentioned in the text. The principal ones are the following:

6. The yellow ſuccinum,
7. The coloured green or blue by foreign matter,
8. The veined ſuccinum,
} opaque.

9. The white,
10. The pale-yellow,
11. The citron-yellow,
12. The deep-red,
} tranſparent.

The golden yellow tranſparent amber, mentioned in the text, is what the ancients called *chryſoleĉtrum*, and the white opaque was called *leucoleĉtrum*.

But we muſt be cautious about the value of the ſpecimens remarkable for their colour, ſize, tranſparency, and the well-preſerved inſects they contain internally; ſince there is a probability of deception, ſeveral perſons poſſeſſing the art of rendering it tranſparent and coloured, and of ſoftening it, ſo as to introduce foreign ſubſtances, &c. into it at pleaſure.

M. Fourcroy ſays, that two pieces of this ſubſtance may be united, by applying them to one another, after being wet with oil of tartar and heated. And Wallerius mentions, that pieces of yellow amber may be ſoftened, formed into one, and even diſſolved by means of oil of turnip-ſeed, in a gentle heat; and that according to ſome authors, it may be rendered pure and tranſparent, by boiling it in rape-ſeed oil, linſeed oil, ſalt-water, &c.

Mr Macquer ſays, that for the purpoſe of making varniſh, this ſubſtance muſt undergo beforehand a previous decompoſition by torrefaction, in order to be diſſolved by linſeed-oil or eſſential oils. See VARNISH.

Beſides the making of varniſhes, this ſubſtance was much employed formerly in making various pieces of ornament and jewellery. The beſt pieces were cut, turned, carved, or plained, to make vaſes, heads of canes, collars, bracelets, ſnuff-boxes, beads, and other toys, ſmall fine cheſts, &c. But after diamonds and beautiful hard ſtones were brought into uſe, theſe trinkets are little conſidered in Europe: nevertheleſs, they are ſtill ſent to Perſia, China, and to various other eaſtern nations, who eſteem them ſtill as great curioſities.

Inflammables.

It is found in the same earthy and stony beds as petrol. Some specimens are of a cylindrical form, like bits of thin branches or stalks of vegetables, though much more flexible, being perfectly elastic.

M. Magellan observes, that this fossil seems to favour the opinion of those mineralogists, "who believe that these oily combustibles derive their origin from the vegetable kingdom. It seems worth trying, whether pieces of asphaltum, buried in damp beds of sparry rubbish, or other kind of earths, would take the same elastic consistence. But since many beds of shells and other fossile substances, both of the vegetable and animal kind, as impressions of various plants, and the remains of various quadrupeds, &c. have been found in different parts of the globe, whose individual species undoubtedly exist no longer alive unless in far distant climates, and in the most remote countries from the spot where their exuvia are dug out; why should we not allow that this new fossil may be the same original elastic gum, now growing naturally in Brasil, China, and other hot climates, only altered in its smell, and in the tenacity of its particles, by its long deposition during centuries in the bowels of the earth?"

This elastic petrol was found in 1785, near Casseltown, in the county of Derbyshire in England, but in very inconsiderable quantities.

D. Hardened rock-oil; fossile pitch. *Petroleum induratum, Pix montana.*

1. Pure asphaltum.

This leaves no ashes or earthy substance when it is burnt.

It is a smooth, hard, brittle, inodorous, black or brown substance. When looked through in small pieces, appears of a deep red colour. It swims in water.

It breaks with a smooth shining surface.—Melts easily: and, when pure, burns without leaving any ashes; but if impure, leaves ashes or a slag.

According to M. Monet, it contains sulphur, or at least the vitriolic acid.

It is slightly and partially acted on by alcohol and æther.

From this, or the preceding substance, it is probable the asphaltum was prepared that the Egyptians used in embalming their dead bodies, and which is now called *mummia*.

It is found also on the shores of the Red Sea, in the Dead Sea, in Germany, and France.—(*Kirwan.*)

And it comes likewise from Porto Principe, in the island of Cuba. (*Brun.*)

It is found also in many parts of China: and is employed as a covering to ships by the Arabs and Indians. (*Fourcroy.*)

2. Impure; *Pix montana impura.* Pissaphaltum.

This contains a great quantity of earthy matter, which is left in the retort after distillation, or upon the piece of charcoal, if burnt in an open fire; it coheres like a slag, and is of the colour of black-lead: but in a calcining heat, this earth quickly volatilises, so that the nature of it is not yet known.

It is found in Mossgrufvan in Norberg, and in Grengierberget, both in the province of Westmanland; and also in other places.

The pissaphaltum is of a mean consistence between the asphaltum and the common petroleum. It is the very bitumen which is collected in Auvergne in France in the well called *de la Pege*, near Clermont Ferrand.

VIII. Jet. *Gagas, Succinum nigrum.*

This is a very compact bitumen, harder than asphaltum, always black, and susceptible of a good polish. It becomes electrical when rubbed; attracts light bodies like the yellow amber; and it swims on water.

It seems to be nothing else than a black amber, or succinum; but specifically lighter, on account of the greater portion of bitumen that enters into its composition. When burned, it emits a bituminous smell. See the article JET.

IX. Mineral phlogiston united with earths.

A. With calcareous earth.

1. With pure calcareous earth. This is the fetid or swine spar formerly described.

B. United with calcareous, argillaceous, ponderous, and siliceous earth and vitriolic acid. Liverstone: *Lapis hepaticus.*

C. With an argillaceous earth; Pit or Stone Coal.

1. With a small quantity of argillaceous earth and vitriolic acid. *Lithanthrax.* See the articles COAL and PIT-COAL.

This is of a black colour, and of a shining texture: it burns with a flame, and is mostly consumed in the fire; but leaves, however, a small quantity of ashes.

a. Solid coal. *b.* Slaty coal.

2. Culm-coal, called *kolm* by the Swedes.

This has a greater quantity of argillaceous earth and vitriolic acid, and a moderate proportion of petrol.

It has the same appearance with the preceding one, though of a more dull texture: it burns with a flame; and yet is not consumed, but leaves behind a slag of the same bulk or volume as the coal was.

From England, and among the alum rock at Moltorp and Billingen in the province of Westergottland.

3. Slate-coal.

This coal contains abundance of argillaceous earth. It burns with a flame by itself, otherwise it looks like other slates.

It is found at Gullerasen in the parish of Rettwik, in the province of Dalarne, and also with the coals at Boserup in Skone.

This seems to be the same with the bituminous schistus, already described among the argillaceous earths.

4. Cannel-coal.

Mr Kirwan has put together this variety of coal with that other called *Killkenny-coal*, tho' they have some different properties.

The cannel-coal is of a dull black colour; breaks easily in any direction; and, in its fracture, presents a smooth conchoidal surface, if broken transversely.

It contains a considerable quantity of petrol, in

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in a lefs denfer ftate than other coals; and burns with a bright lively flame, but is very apt to fly in pieces in the fire. It is faid, however, to be entirely deprived of this property, by being previoufly immerfed in water for fome hours.

Its fpecific gravity is about 1270; and being of an uniform hard texture may be eafily turned in the lathe, and receive a good polifh.

It is from this kind of coal that fmall vafes, as ink-ftands, various trinkets, and other curiofities, are made in England, which appear as if made of the fineft jet.

5. Kilkenny-coal.

This contains the largeft proportion of petrol or afphaltum; burns with lefs flame and fmoke, and more flowly, though intenfely, than the cannel-coal.

The quantity of earth in this coal does not exceed one twentieth of its weight. Its fpecific gravity is about 1400. It is frequently mixed with pyrites.

It is found in the county of Kilkenny, belonging to the province of Leinfter in Ireland. The quality of this coal burning almoft without fmoke, is mentioned in a proverb by which the good qualities of this county are expreffed.

6. Sulphureous coal.

This confifts of the former kinds of coal, mixed with a notable proportion of pyrites: hence it is apt to moulder and break when expofed to the air. It contains yellow fpots that look like metal; and burns with a fulphureous fmell, leaving either red afhes, or a flag, or both. Water acts upon it, after it has mouldered. Its fpecific gravity is = 1500, or more.

Befides the above varieties, fchiftus, micaceous fchiftus, and gneifs, are frequently found in the neighbourhood of coal-mines, fo penetrated with petrol bitumen as to conftitute an inferior fpecies of coal; but the bitumen being burnt, they preferve their form, and in fome meafure their hardnefs. Alfo fome grey flates, that are fo foft as to be fcraped with the nail, and are greafy to the touch, burn like coal.

All the differences of coal arife from a mixture of the varieties already mentioned; and it is obfervable, that wherever coals exift, flates are generally found near them. Salt or mineral fprings are alfo often found in their neighbourhood. (*Kirwan.*)

7. Bovey coal. *Xylanthrax.*

This is of a brown, or brownifh black colour, and of a yellow laminar texture.

The laminæ are frequently flexible when firft dug, though generally they harden when expofed to the air.

It confifts of wood penetrated with petrol or bitumen; and frequently contains pyrites, alum, and vitriol.

Its afhes afford a fmall quantity of fixed alkali, according to the German chemifts; but according to Mr Mills they contain none.

By diftillation it yields an ill fmelling liquor, mixed with a volatile alkali and oil, part of which is foluble in fpirit of wine, and part infufible, being of a mineral nature

It is found in England, France, Italy, Swifferland, Germany, Ireland, &c. (*Kirwan.*)

8. Peat. *Geanthrax.*

There are two forts of inflammable fubftances known by this name, viz.

The firft of a brown, yellowifh brown, or black colour, found in moorifh grounds; in Scotland, Holland, and Germany. When frefh, it is of a vifcid confiftence, but hardens by expofure to the air. It confifts of clay mixed with calcareous earth and pyrites; and fometimes contains common falt. While foft, it is formed into oblong pieces for fuel, after the pyritaceous and ftony matters are feparated. When diftilled, it affords water, acid, oil, and volatile alkali. Its afhes contain a fmall proportion of fixed alkali. They are either white or red, according as it contains more or lefs ochre or pyrites.

The fecond is found near Newbury in Berkfhire. It contains but little earth; but confifts chiefly of wood, branches, twigs, roots of trees, with leaves, grafs, ftraw, and weeds. (*Kirwan.*)

9. Stone-turf.

Cronftedt has ranged the turf among the foffils of his Appendix; but as that called in England by the name of *ftone-turf* contains a confiderable proportion of peat, it may be mentioned with propriety in this clafs.

Soon after it is dug out from the ground, where it keeps a foft confiftence, it at firft hardens; but afterwards it crumbles by long expofure to the air

As to the other common turf, it only confifts of mould interwoven with the roots of vegetables; but when thefe roots are of the bulbous kind, or in a large proportion, they form the worft kind of turf.

Although it may appear incredible, it is neverthelefs a real fact, that in England pit-turf is advantageoufly employed in Lancafhire to fmelt the iron-ore of that county. Mr Wilkinfon, brother-in-law to Dr Prieftley, and famous for his undertakings in the extenfive iron-works, perhaps the greateft in Europe, makes ufe of pit-turf in his large fmelting furnaces of that province.

Those foffil fubftances, which furnifh fuel for the various purpofes of human life, are diftinguifhed by the name of *coals*, on account of their being a fuccedaneum for wood and other vegetable productions, which when dry or of an oleaginous kind ferve for the fame ufes. If thefe vegetable fubftances are deprived of the accefs of air, by covering them after ignition, the half-confumed remainder, which is of a black colour, is called by the name of *coal* or *charcoal;* and from hence the foffil which affords fuel has alfo

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also been called by the same name, though of a very different nature.

Pit-coal and earth-coal are synonymous, and mean coals dug out of a pit or from the earth. But the lithanthrax denotes stone-coal, and more properly indicates the cannel-coal, which has the greatest similarity to a stony substance, by the dull appearance of its fracture and by the uniform texture of its parts.

All these coals are in general a bituminous black or brown and dark substance: for the most part they have a lamellated texture, which breaks easily, and always with a shining surface.

The varieties of pit-coals above-mentioned are the most remarkable, by which they may be distinguished from one another. But they are far from being homogeneous in each kind; as the accidental qualities, and the various proportions of their component parts, produce a far greater number of properties, which renders them more or less fit for different purposes; though these are generally overlooked, and confounded with the common one of affording fuel for making fire to warm our rooms, or for culinary operations.

This fossile bitumen, as Fourcroy remarks, being heated in contact with a body in combustion, and a free access of air, kindles the more slowly, and with more difficulty, as it is more weighty and compact. When once kindled, it emits a brisk and very durable heat, and burns for a long time before it is consumed. If extinguished at a proper time, the remaining cinders may serve several times for a new firing with a small addition of fresh coals. The matter that is burned, and produces the flame, appears very dense, as if united to another substance which retards its destruction. Upon burning, it emits a particular strong smell, which is not at all sulphureous when the earth-coal is pure, and contains no pyrites.

When the combustible, oily, and most volatile parts, contained in the earth-coal, are dissipated and set on fire by the first application of heat; if the combustion is stopped, the bitumen retains only the most fixed and least inflammable part of its oil, and is reduced to a true charry state, in combination with the earthy and fixed base. Pit-coals in this charry state are called *coaks*, which are capable of exciting the most intense heat; and are employed all over Britain in the smelting of iron, copper, and other metallic ores, to the greatest advantage. See COAKS, COAL, COALERY, and PIT-COAL (E).

X. The

‡ *Nat. Hist. of the Mineral Kingdom.*

(E) The coal-metals, or stone strata inclosing coals, are very numerous. Mr Williams ‡ gives the following general account of those in Scotland.

The sand-stones. Of these there is a great variety, distinguishable by colour, texture, and degrees of hardness, generally disposed into thick, middling, and thin strata. The only species our author takes notice of is the regular broad-bedded free-stone of a laminated texture. This commonly rises in thin or middling strata; appearing at the edges of a section, when broken or cut, to be formed of thin lamina or layers of sand, equally laid on the whole breadth of the stone, and well cemented together. A great deal of both red and white free-stone rise in layers of five or six inches, and so upwards, with regular streaks of a fifth or sixth part of an inch appearing the whole length of the stone, when the edge of a slab is polished, as if so many gentle waves of water had formed the layer. The regularity of the structure of this stone corresponds exactly with the regularity of its layers; and our author is of opinion, that the flaggy grey-strata of free stone, with many of the black and grey-strata of coal metals, the grey slate, as well as many other thin strata of the coal metals, may be ranked with this free stone for perfect and regular stratification.

Along with these he classes some of the thin argillaceous strata. "Many of the grey regularly stratified mountain limestones (says he) are also streaked or striped; and the streaks in these appear more conspicuous when broken than the streaked free stones. Some of the hard regularly stratified mountain rocks are also stratified; and in all these three kinds of stones, the streaks are regularly and exactly parallel to the bed of the stone."

Another remarkable instance of regularity of strata is met with in the grey flaggy strata of Caithness.—Throughout all the low country of Caithness, a square of about 10 or 15 miles, there are bluish argillaceous strata, with generally a small quantity of lime in the composition of the stone, which is indurated to a greater degree than is common to such thin strata. The stone is strong and tough, every where disposed in thin broad-beded, regular strata; and in several parts of the country the flags are so thin and regular, and are raised so light and broad, that they are used for covering houses; and three or four of them will cover the side of a small one. Our author mentions a gentleman who has an estate on the south side of the Pentland frith, and who in a bay there raises flags of any size and thickness he pleases; "so truly flat and smooth, that he has only to square the edges to make of them good loft-floors, partitions, chests, mangers, roofs of houses; in short, he does every thing with them. The face of these flags are as smooth and true a plane, as if artificially finished by the best workman."

In most coal fields there are a great variety of strata of different kinds accompanying and lying between the seams of coal, of all sorts of colours, consistencies, and dimensions; all of them blended together without any certain order or regularity; so that if there be 20 seams of coal, it is possible that there may be as many different roofs; that is, the stratum which is the immediate roof of one seam of coal, shall differ from that of another seam in quality, thickness, and colour, so that perhaps no two of the twenty shall be in any respect alike.

The various kinds of coal-roofs (*a*) commonly met with are the following.

1. *Ba-*

(*a*) The stratum which is placed immediately above a seam of coal, is called the *roof* of the coal, and that which is placed immediately below the seam, is called the *pavement* of the coal: which three, viz. the stratum of coal, and its roof and pavement, with the other concomitant strata lying above and below them, always preserve their stations and parallelism; that is, are all stretched out and spread one above another upon the same inclining plane, and have the same line of bearing and of declivity.

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X. The mineral phlogifton or bitumen, united with the vitriolic acid: fulphur or brimftone. See the article SULPHUR.

This is very common in the earth, and difcovers itfelf in many and various forms. It is found,

A. Native. *Sulphur nativum.*

In this the two conftituent parts are mixed in due proportion in regard to each other, according to the rules of that atttraction which is between them. It is eafily known,

1. By its inflammability, and by its flame.
2. By its fmell when burnt; and,

3. By

1. *Bafaltes.* This is very common in Scotland, where it is frequently called *whin* ftone; and at Borrowftounnefs there are feveral thick beds of it between the feams of coal. One of them being the immediate roof of a feam of coal there at Hillhoufe lime quarry, there is a thin feam of coal beneath a beautiful bed of columnar bafaltes. In the Bathgate hills to the fouthward of Linlithgow, alfo, there are feveral ftrata of coal blended with thofe of bafaltes. Thefe bafaltine ftrata are always very hard, frequently very thick, and generally of a black or blackifh grey colour. "There are but few people (fays Mr Williams) fufficiently verfed in natural hiftory, to know that they are bafaltes, as this kind of rock, both in England and Scotland, goes by the name of *whin rock.* In the north of Scotland it is called *fkurdy*; and among the miners in Cornwall it has the name of *cockle* (*b*)."—

2. Strata of *limeftone* of various thickneffes are met with in different coal-fields. Sometimes the lime is the immediate roof; but fometimes there is an argillaceous ftratum of about the thicknefs of a foot between the coal ftratum and that of lime. In the coal-fields at Gilmerton, near Edinburgh, are feveral beds of limeftone, fome of them very good, and of confiderable thicknefs. At Blackburn in Weft Lothian, alfo, there is a ftratum of limeftone fix or feven feet thick, which is the immediate roof of a feam of coal about five or fix feet thick. At Carlops and Spittlehaugh in Tweedale, they have a feam of coal immediately below their lime quarries, which they work for burning their lime.

3. *Poft-ftone,* a kind of thick and folid ftratum of free ftone, is one of the roofs of coal, generally without the intervention of any argillaceous ftratum, though fometimes a ftratum of this kind is interpofed. Frequently this kind of ftone is rendered very hard by a mixture of iron or pyrites. In moft coal fields, thinner ftrata of free ftone are met with as the roofs of coal feams.

4. *Dogger-band,* as it is called by the Scots colliers, is frequently met with as the roof of coal feams. This name is applied to various fubftances. Sometimes they call ftrata of iron-ftone *dogger bands*; fometimes the name is reftricted to the ball iron-ftone; fometimes to pyrites; and fometimes the dogger band is a kind of imperfect ftone, compofed of feveral heterogeneous mixtures, among which pyrites bears a confiderable proportion, and by which the whole is fo ftrongly bound together, that it is frequently very difficult to break through it.

5. *Whin-ftone,* properly fo called, not of a bafaltic nature. Thefe roofs are always very hard, and of various colours, as black, blackifh grey, brown, red, &c. fometimes not above two or three feet in thicknefs, but fometimes much more.

6. *Poft-ftone,* of a fofter nature than that already mentioned. This has no mixture of ferruginous matter.

7. *Regular ftrata of free-ftone,* of various colours, textures, and thickneffes, but not fufficiently thick to deferve the name of *poft-ftone,* which our author thinks they do not, unlefs they are above three or four feet. Thefe thin ftrata of free ftone are very numerous in coal fields, and very frequently form the roofs of coalfeams. Some of them are three or four feet thick, while others do not exceed three or four inches. They make good roofs, eafily cut through, and may be readily quarried out for other purpofes.

8. *Grey-bands,* or grey-coloured free-ftone, frequently form the roofs of coal feams. A great number of them are generally arranged in one place, lying immediately above one another; and they are frequently found of all degrees of thicknefs from one to twenty inches, though the moft common dimenfions are from two to fix. By the Scots colliers thefe are called *grey fekes* as well as grey bands. Frequently they are found of moderate hardnefs, and fufficiently ftrong to make good flags and covers for fewers. Thefe roofs are ftrong and fafe when the ftone partakes of the nature of the coal, and has a black or blackifh grey colour; but when they have a mixture of tilly or argillaceous matter, they are more friable.

9. *Blaes,* when hard, ftrong, and well ftratified, are reckoned tolerably good coal-roofs. Thefe are always of a bluifh-black or black-grey colour, and are of great variety in refpect to hardnefs and ftrength. Some of the ftrongeft and hardeft are either entirely black or greyifh black; while fome of the different fhades of black are pretty thick, and others are but thin. The thickeft, however, are not above 18 inches, and the thinneft two or three inches or lefs. The medium thicknefs is from one foot to three or four inches. Some of them are fufficiently hard to make a good and fafe coal-roof; but they feldom acquire fuch a degree of hardnefs as to give any confiderable obftruction in fucking. All of them feem to have a confiderable quantity of black argillaceous matter in their compofition; and the ftrong blaes have alfo a confiderable quantity of fand; often alfo containing a large portion of empyreumatic oil, and fometimes have a confiderable mixture of coaly matter. There is a great variety both in the thicknefs and quantity of thefe blaes found above feams of coal. In fome places the thinneft ftrata make the immediate roof; in others, the thickeft. Sometimes we find only five or fix inches of blaes upon the coal; in others as many fathoms, or even much more; and it is common to find them of all the intermediate thickneffes.

10. Whitifh

(*b*) We muft obferve, however, that according to Bergman and other eminent mineralogifts, the *cockles* or *fhirls* ought not to be confounded with *bafaltes*; which laft name does not at all fit thofe fubftances. See *Volcanic Products* in the Appendix to this article.

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3. By its producing a liver of fulphur, when mixed with a fixed alkali, like that made from artificial fulphur. It is found,

a. Pellucid, of a deep yellow colour.

b. Opaque, white, and greyifh.

Thefe are found in Siberia, at Bevieux in Swifferland, and at Salfatara near Naples.

c. Cryftallifed in octoedral prifms, with blunted points.

d. Tranfparent. Mr Davila had been informed that this was brought from Normandy in France. (*Brun.*)

1. Native fulphur is found in different forms, *viz*. either in folid pieces of indeterminate figure, running in veins through rocks; or in fmall lumps, in gypfum and limeftones; in confiderable quantities at Solfatara, and in the neighbourhood of volcanoes; or cryftallifed in pale, tranfparent, or femitranfparent, octogonal, or rhomboidal cryftals, in the cavities of quartz; and particularly in the matrices of ores; or in the form of fmall needles over hot fprings, or near volcanoes (*Kirwan*).

Some-

Inflammables.

10. *Whitifh and afh-coloured argillaceous ftrata*, of middling ftrength, are frequently found to be the immediate roofs of coal. Some of thefe are of middling thicknefs, others thin. They are commonly found from two inches to two feet in thicknefs. A great many of thefe roofs are very dangerous on account of their fragility; while others are quite fafe, owing to the more perfect formation of their ftrata, or to fome ingredient in their compofition.

11. *Streaked roofs*. Thefe are of two forts: 1. Such as are compofed chiefly of fand, with a very fmall mixture of clay and blaes; and, 2. Thofe compofed principally of clay or blaes with a fmall quantity of fand. Some of thefe have large, others fmall, ftreaks or ribs. Mr Williams fays that he has feen them fo beautifully ftreaked as to refemble the fineft ftriped cotton ftuffs. Thefe ftripes or ftreaks always lie exactly parallel to one another, as well as to the bed of the ftone, and are always fpread out the whole breadth of the ftratum. Their colours are various in different ftrata, fome of the ftripes being nearly black and white, others white and red, and others yellow and red. In fome the ftripes appear of a lighter and darker grey colour. Some of the finely ftriped ftones have their ftreaks about a quarter of an inch in diameter; fometimes lefs: and it is common to fee ftripes from a quarter to three quarters of an inch broad; but in the finely ftriped ftones it is rare to find them a full inch thick without fome different fhade on one fide or other of the ftripe. The fecond kind of thefe ftreaked roofs, viz. fuch as are compofed of blaes, with a fmaller mixture of fand, differ but little from the former; only the colours are not always fo bright, nor the ftripes fo fine; neither is the roof quite fo hard.

12. *The foft blae roofs* fometimes confift of pretty thick ftrata; others of fuch as are thin or of middling thicknefs. There are likewife arrangements or claffes of regularly ftratified blaes, found immediately above feams of coal, from three or four inches to feveral fathoms in thicknefs, though fome are even met with little exceeding one inch in thicknefs; though in the fame place there might be a confiderable thicknefs of blaes above the coal, taking in all the different ftrata, thick and thin, which lay above it. Some of thefe roofs have an oily appearance on the outfide, and through all the fiffures and joints of the ftrata; that is, they appear fmooth and gloffy, and are very flippery to the touch. Others have no appearance of this kind; but all of them are tender, weak, and fragile, fo that they make a very indifferent and dangerous roof.

13. Another kind of coal-roof confifts likewife of *blaes*, but fuch as are *imperfectly ftratified*. It is altogether the fame in quality and colour as the laft, the only difference that can be diftinguifhed being in the different degrees of ftratification. The beds of this kind are not perfect, but unequal; whence it is a bad and dangerous roof, as great pieces of it are frequently apt to fall down by reafon of the inequality and different joints of the ftrata. Some of thefe blaes appear in thick, and others in thin or middling thick beds; while fome have an oily fmoothnefs, called by the Scots colliers *creefhy* (greafy) *blaes*. It is owing to this oilinefs particularly that thefe kinds of roofs are fo dangerous; for the oil pervades the joints, and, rendering them flippery, makes the pieces more apt to fall out as foon as the coal is worked away from below them. Some of thefe have fuch a quantity of natural oil, that they will flame a little in the fire; and in fome places there are hard blaes which will burn when fire is fet to them, though they will not confume. At Pitfirran in Fifefhire there is a fpecies of this blaes fo inflammable, that when fire is fet to one corner of a hillock it will burn throughout the whole; neverthelefs it is not reduced in bulk by this combuftion, nor does it produce any afhes. Inftead of this it becomes confiderably harder than before, and acquires a pale red colour. By reafon of its hardnefs, it is proper for being laid upon horfe and foot paths, but is not fo for roads over which heavy wheel-carriages pafs.

14. *Soft blaes not ftratified at all*. Of thefe there is no more than one bed from two or three inches to feveral fathoms in thicknefs, without any others either above or below it. They are as common as any above the coal feams; but their fubftance is not always uniform throughout the whole ftratum. Some of them are found divided into fmall angular maffes, and others into larger ones; but whether thefe are uniform or not, they always make a bad and dangerous roof. Thefe argillaceous ftrata are fometimes called *beds of till*; the uniform fort are called *dauk*, and the glebous kind *lipey* blaes, by the Scots colliers. Both the uniform and glebous foft blaes frequently contain a quantity of ball iron-ftone, though fome of it contains none at all. The regular continuous ftrata of iron-ftone are commonly found in ftratified foft blaes. There is a variety of foft coal-roofs of a grey colour, and of which fome are regularly ftratified, and fome not.

15. *Re-*

Sometimes it is formed in old privies: of this Mr Magellan faw fome lumps that were found in a very old one at Paris.

2. United with clay in the aluminous ore of La Tolfa, and alfo at Tarnowitz in Silefia. This laft refembles a light grey earth: when dry, burfts or cracks in the water like marl; and poffeffes a ftrong peculiar fmell like camphor. If diftilled, the fulphur fublimes. One hundred parts of this earth afford eight of fulphur, befides gypfum and a quantity of iron.

3. Mixed with clay, iron, and felenite. This compound is of a grey, brown, or black colour, found near Rome, Auvergne, Spain, and Iceland.

4. With limeftone in the form of a calcareous hepar. This is found at Tivoli, near Rome, and elfewhere in Italy. It is fometimes diffolved in mineral waters, three pounds of which contain as much as 25 grains of fulphur. It often forms incruftations on the brinks of thefe fprings.

5. In the form of an alkaline hepar. This is faid to be found in fome waters in Ruffia; as will be hereafter noticed.

6. United to iron and clay of pyrites, &c. of which hereafter.

7. United to metallic fubftances, as hereafter fpecified.

B. Saturated with metals (F).

1. With iron. Pyrites, or copperas-ftone; *Pyrites.*

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15. *Regularly foft grey coal-roofs.*—Of thefe there are feveral forts. Some have a confiderable quantity of fand in the compofition of the ftrata; and many of thefe are as regularly ftratified as any coal-metals whatever. Numbers are found very thin, and others of middling thicknefs; though in all cafes they are fo tender and friable, that they make very bad and dangerous roofs. Some of them indeed look pretty well at firft but they foon crumble and come down, efpecially when they have been expofed to the air. This, in the opinion of Mr Williams, is owing partly to their having too much clay in their compofition, and partly to the want of a fufficient quantity of natural cement to connect the feveral particles of the ftone together.

16. *Soft grey regular ftrata*, or grey bands of an argillaceous kind; and of thefe there is likewife a confiderable variety. Some are of a dark, others of a lighter grey; fome thick, others thin: they are very numerous in coal-fields, and are frequently to be found as the immediate roofs of coal. Thefe, as well as the black kinds, are found in all quantities or degrees of thicknefs above different coals, from a few inches up to feveral fathoms; but whether they be in great or fmall quantity, the roof they compofe is generally very frail and tender.

17. *Soft grey argillaceous bands, imperfectly ftratified.* Thefe differ little or nothing in fubftance from the former; the only difference is in the ftratification. Many of the ftrata of the former are of a middling thicknefs, or rather thin, finely and regularly fpread out, and every part of each ftratum of an equal thicknefs. But this fort, though it has the appearance of ftrata, is clumfy and irregular; that is, the feveral beds are unequal, and divided by many irregular joints into unequal mifhapen maffes, which makes this a very bad roof; the maffes being apt to feparate at the joints, and to fall down when the coal is worked out from below them.

18. *Soft grey argillaceous beds* of metal or coal roofs *not ftratified at all.* Thefe are of two kinds, *viz.* 1. fuch as are found broken or formed in the ftratum into glebes or maffes; and, 2. fuch as are found in one uniform mafs throughout the whole bed, without any divifion into maffes or ftrata. Thefe grey foft roofs are of all degrees of thicknefs, from a few inches up to many fathoms, as well as the black; and there is but very little difference between them in any refpect excepting the colour. But in this, as well as in the black unftratified blaes, and that both in the glebous and uniform beds, ball or glebous iron-ftone is frequently found; and ftrata of iron-ftone are alfo found in the ftratified foft grey blaes.

19. *White and afh-coloured foft argillaceous coal-roofs*; and of thefe there is alfo a great variety. Some of this kind are regularly ftratified, others imperfectly, and fome not at all. Some of the whitifh argillaceous roofs are compounded of gritty fand and clay; others appear to be chiefly compofed of pure clay; and fome of a loamy clay. Thofe which are regularly ftratified and mixed with fand, either coarfe or fine, are of great variety with regard to thicknefs and the arrangements of the ftrata; but all of them are tender and fragile, and thus make very troublefome and dangerous roofs.

20. *Whitifh argillaceous roofs, ftratified*, and of a homogeneous quality, or not mixed with fand. Some of thefe are finely and perfectly ftratified, and are of different degrees of hardnefs; but in general, make but a weak roof. Some of them are found in irregular ftrata, with all the other varieties and imperfections already mentioned.

21. *White and afh-coloured argillaceous coal-roofs*, not *ftratified at all.* Sometimes thefe are found in very thick beds in the coal-fields; and fome of thefe, as well as of the black foft roofs, rife in glebes and maffes of different fizes; while others are homogeneous throughout the whole bed, however thick, from two or three inches to feveral fathoms. Some of thefe beds of white argillaceous marle-like matter are found to be a fandy or loamy clay; others a pure homogeneous clay, which does not feel gritty between the fingers nor in the mouth. The fhades and varieties of this kind are as numerous as thofe of any of the foregoing; and all of them, by the Scots colliers, are called *dauk*, whatever be their coour. Mr Williams informs us, that he has frequently taken fome of thefe fine white clays to wafh his hands, and has found them anfwer almoft as well as foap.

(F) Sulphur is the moft common mineralifer of metals; and therefore moft of its combinations with thofe fubftances fall to be ranked hereafter among the metallic ores.

Inflammables.

rites. This is the fubftance from which moft fulphur is prepared, and is therefore ranked here with all its varieties. It is hard, and of a metallic fhining colour.

A. Pale yellow pyrites; *Pyrites fubflavus.* Marcafite. This is very common, and contains a proportionable quantity of fulphur with refpect to the iron; when once thoroughly inflamed, it burns by itfelf.

a. Of a compact texture; *Polita piedra del ynca, Hifpanorum.*

b. Steel-grained.

c. Coarfe-grained.

d. Cryftallifed. It fhoots moftly into cubical and octoedral figures, though it alfo cryftallifes into innumerable other forms.

B. Liver-coloured marcafite. Its colour cannot be defcribed, being betwixt that of the preceding marcafite and the azure copper ore. The iron prevails in this kind; it is therefore lefs fit to have fulphur extracted from it, and alfo for the fmelting of copper ores. It is found,

a. Of a compact texture.

b. Steel-grained.

c. Coarfe-grained.

C. Varioufly combined with iron and other metallic fubftances.

1. With iron and copper; forming yellow or marcafitical copper ore.
2. With iron, filver, and lead; potters lead ore.
3. With iron and zinc; mock lead, black jack or blende.
4. With iron and arfenic; arfenical pyrites.
5. With iron and cobalt.
6. With iron and bifmuth.
7. With iron and nickel.
8. With iron and gold; pyritical gold ore.
9. With filver; glafs filver ore.
10. With copper; grey or vitreous copper ore.
11. With lead; potters lead ore.
12. With bifmuth.
13. With quickfilver; cinnabar.
14. With arfenic; orpiment, realgar.

XI. Mineral phlogifton mixed with metallic earths.

This is not found in any great quantity: in regard to its external appearance, it refembles pit-coal; and the fat fubftance contained in it, at times, partly burns to coal, and partly volatilifes in a calcining heat.

The only known varieties of this kind are,

A. Minera cupri phlogiftica.

When it has been inflamed, it retains the fire, and at laft burns to afhes, out of which pure copper can be fmelted.

B. Minera ferri phlogiftica.

This is not very different in its appearance from the pit-coal or foffile pitch, but it is fomewhat harder to the touch. There are two varieties of this fpecies:

1. Fixt in the fire; *Minera ferri phlogiftica fixa.*

Expofed to a calcining heat, it burns with a very languid though quick flame; it preferves its bulk, and lofes only a little of its weight. It yields above 30 per cent. of iron.

a. Solid, which refembles black fealing-wax.

b. Cracked, and friable.

2. Volatile in the fire.

This is unalterable in an open fire, either of charcoal, or even upon a piece of charcoal before the flame of the blow-pipe; but under a muffle the greateft part of it volatalifes, fo that only a fmall quantity of calx of iron remains. It is found,

a. Solid.

b. Cracked.

This laft kind leaves more afhes: thefe afhes, when farther expofed to the fire, become firft yellowifh-green, and afterwards reddifh-brown; when, befides iron, they then alfo difcover fome marks of copper: it has, however, not been poffible to extract any metallic fubftance from them, the effects of the loadftone, and the colour communicated to the glafs of borax, having only given occafion to this fufpicion.

Metals.

Class IV. METALLIC SUBSTANCES.

Metals are thofe minerals which, with refpect to their volume, are the heavieft of all known bodies. Some of them are malleable; and fome may be decompounded; and, in a melting heat (G), be brought back again to their former ftate by the addition of the phlogifton they had loft in their decompofition. See Metallurgy, Part I. Sect. i. and Chemistry-*Index* at *Metallic Calces* and *Metals.*

All the metallic fubftances contain phlogifton; and when, to a certain degree, deprived of it, fall into a powder like an earth; but their attractions for phlogifton are different.

Moft of them, when melted in a common way, and expofed to the air, have an earthy cruft formed upon the furface, which cannot again be reduced to metal without the addition of fome inflammable matter. The bafe metals have this property.

But the noble metals, *viz.* platina, gold, and filver, are fo firmly united to the phlogifton, that they never calcine under fufion, however long continued; and, after being changed into a calx in the liquid way, when melted in the fire, they reaffume their metallic form without any other phlogifton than what is contained in the matter of heat.

Quick-

(G) The various degrees of heat required to reduce metals to a fluid ftate, are feen in the following table, which was extracted, for the moft part, by Dr Withering, from the printed treatifes of the late celebrated Profeffor Bergman. It exhibits, in a fimple view, 1. The fpecific gravity of each metal; 2. The degree of heat by Fahrenheit's fcale, in which it melts; 3. The quantity of phlogifton it requires for its faturation; and,

4. Its

Quickfilver holds a kind of middle place: for, like the bafe metals, it may be calcined, though not readily; and, like the noble ones, it may be reduced by heat alone.

We may therefore reckon four noble or perfect metals; *viz.* gold, platina, filver, and mercury; becaufe, when calcined, they recover their phlogifton without the addition of any phlogiftic fubftance.

But as tin, lead, copper, and iron, cannot be reduced without fuch addition, thefe are called *ignoble* and *imperfect* or *bafe metals*. *Kirwan's Mineralogy.*

However, all thofe eight metals (even mercury, when folid) are malleable to a confiderable degree, and are called *entire metals.* But

Bifmuth, zinc, antimony, arfenic, cobalt, nickel, manganefe, molybdena, and wolfram, are fcarce at all malleable, and hence they are called *femimetals.* Nevertheless, zinc and purified nickel are more malleable than any of the other femimetals; fo that we have four perfect or noble metals, four imperfect or bafe, eight entire, and nine femimetals (H).

Order

4. Its attraction to the fame faturating phlogifton. We muft, however, obferve, that if the fecond column be compared with that of Wedgwood's thermometer, their great difagreements betray fome fundamental error in the affumed data: for the degrees of heat affigned by Mr Wedgwood for melting gold, filver, and copper, are more than quadruple of thofe affigned by Bergman, and that for melting iron is more than eleven times greater; although they both nearly agree in the red heat of iron, which Bergman fays to be 1050 degrees, and Wedgwood 1077. Mr Magellan is of opinion, that the fault lies in Mortimer's thermometer, which Bergman quotes with fome diffidence (Sect. 197. of his *Sciagraphia*); and thinks it probable, that the changes caufed by heat, on this metallic thermometer, are in a much lefs increafing proportion by intenfe fire, than thofe indicated by the contraction of the pure clay, happily employed by Wedgwood in his thermometer. He therefore added another column to this table, marked *Wedgw.* with the degrees of the melting heats already afcertained by this laft thermometer, as being the neareft to truth.

Metals.		Specific Gravity.	Melting Heat. *Berg*	Melting Heat. *Wedgw.*	Saturating Phlogifton.	Attraction to faturating Phlogifton.
Gold		19,640	1301	5237	394	1 or 2
Platina		21,000			756	1 or 2
Silver		10,552	1000	4717	100	3
Quickfilver		14,110	—40	—40	74	4
Lead		11,352	595		43	10
Copper		8,876	1450	4587	312	8
Iron		7,800	1601	17977	342	11
Tin		7,264	415		114	9
Bifmuth		9,670	494		57	7
Nickel	common	7,000	1301		156	11
	pure	9,000	1601		109	5
Arfenic		8,308				
Cobalt	common	7,700	1450			
	pure		1601			
Zinc		6,862	699		182	11
Antimony		6,860	809		120	6
Manganefe		6,850	Very great		227	11

N. B. By faturating phlogifton, Profeffor Bergman means to exprefs the proportionate quantities taken away from each metallic fubftance, when diffolved by means of acids, and of courfe reduced to a calciform ftate. The laft column only expreffes their attraction to this part of their phlogifton, not to that which ftill remains united to them in a calciform ftate. *Withering.*

(H) Mr Mongez remarks, that the following are the general properties of metals, when confidered as phyfical bodies; *viz.* their opacity, great fpecific gravity, ductility, tenacity, cryftallization, flavour, and even fmell, at leaft in fome of them.

It is from their denfity that their gravity and opacity proceed; this laft being fuch, that, even reduced to the thinneft plates, no rays of light can pafs through their particles, unlefs there remains an interftice or pore quite free from the metallic fubftance. Gold leaf muft, however, be excepted, which exhibits a fine green by tranfmitted light.

As to their cryftallization, it has been found to take place whenever they are pure, and left to cool very flowly by themfelves, after having been perfectly fufed. (See *Journal de Phyfique* for July 1781, p. 74.) The flavour and fmell above mentioned are very perceptible in the reguline fubftances of arfenic and antimony, as well as in lead, copper, and iron.

All metals are conductors of electricity; and more perfectly fo than any other bodies during their union with phlogifton.

They

METALS. Gold.

Order I. NOBLE OR PERFECT METALS.

I. Gold; *Aurum sol chymicorum*. See the articles GOLD; also CHEMISTRY-*Index*; and METALLURGY, Part II. sect. 1.

This is esteemed the principal and first among the metals; and that partly for its scarcity, but chiefly for the following qualities:

1. It is of a yellow shining colour.
2. It is the heaviest of all known bodies, its specific gravity to water being as 19,640 to 1000.
3. It is the most tough and ductile of all metals; because one grain of it may be stretched out so as to cover a silver wire of the length of 98 yards, by which means $\frac{1}{1051000}$ of a grain becomes visible to the naked eye.
4. Its softness comes nearest to that of lead, and consequently it is but very little elastic.
5. It is fixed and unalterable in air and water, and is indestructible by the common action of fire.
6. When melted, it reflects a bluish-green colour from its surface.
7. It dissolves in aqua-regia, in the dephlogisticated marine acid, and also (according to Crell ‡) in an acid obtained by distilling vitriolic acid from off manganese.
8. When mixed with a volatile alkali and a little of the acid of nitre, by means of precipitation out of aqua-regia, it burns off quickly, in the least degree of heat, with a strong fulmination.
9. It is dissolved, *in forma sicca*, by the liver of sulphur, and also somewhat by the glass of bismuth (I).
10. It is not carried away by the antimony during the volatilisation of that semi-metal, and is therefore conveniently separated from other metals by the help of crude antimony; in which process the other metals are partly made volatile, and fly off with the antimony, and partly unite with the sulphur, to which the gold has no attraction, unless by means of some uniting body, or by a long digestion (K).

11. The

‡ *Journal Physique*, Oct. 1785, p. 297.

They are soluble either in nitrous acid and in dephlogisticated marine acid, or in aqua regia; and are precipitable in some degree by caustic alkalies; and except platina by the Prussian alkali.

When dephlogisticated, they communicate a tinge to borax and to microcosmic salt, or at least render them opaque.

They assume a convex surface when melted, and even a globular form, if in a small quantity; and though they mix for the most part with one another whilst fused, yet they refuse to unite with unmetallic substances, even their own calces, iron only excepted, which does to its own calx slightly dephlogisticated and to plumbago. Nickel also, and some others, may contain sulphur in their reguline state.

Metals, when calcined, are capable of uniting with other calces and salts.

Three of the metallic calces have been found to be of an acid nature; *viz.* the arsenical, molybdenic, and tungstenic; from which, by analogy, the nature of other calces may be conjectured.

The phlogiston contained in metals is in a pure state; *viz.* without water and aerial acid, with which it is invariably accompanied in all other compounds except acid airs and sulphur.

When metallic substances are naturally found in the earth united to their full share of phlogiston, and consequently possessing their peculiar properties, they are called *native*.

But when they are found more or less deprived of their phlogiston and of their properties, combined with other substances, they are then called *mineralised*. This is the most common state of the mineral kingdom. The substance so combined with them is called the *mineraliser*, and the whole is called *ore*; by which name are also distinguished these earths and stones in which metallic substances are contained.

But if both metallic substances are mixed together in their metallic or reguline form, without the loss of phlogiston, they are then said to be alloyed.

When the mineraliser is of a saline nature, and renders the metallic combination soluble in less than 20 times its weight of water, the compound is ranged among salts. Thus the vitriols of iron, copper, and zinc, are rather classed with salts than with ores.

The most common mineralisers are, sulphur, arsenic, and fixed air or aerial acid. The least common are the vitriolic and the marine acids. The phosphoric has been found only in two instances; *viz.* united to lead, discovered by Gahn; and to iron, in the siderite, as Mr Meyer believes.

Those metallic substances, mineralised by aerial acid, are called *calciform ores*.

M. Magellan observes, that if the new doctrine of the French chemists, who assert, that calces of metals are a compound of dephlogisticated or vital air with the metallic substance, were just, all calciform ores should produce this vital air instead of aerial acid, when they are reduced to their metallic form; which is not the case: neither should all the base metals and semimetals absolutely require the mixture of some phlogistic substance in order to their being reduced from the state of calces to their metallic form, which otherwise would be quite useless, if their reduction simply consisted in their separation from the vital or dephlogisticated air.

(I) Neither sulphur nor fixed alkali has any action on gold; but the liver of sulphur, which is a compound of both, can dissolve it in the dry way; so that if a proper quantity of gold-leaves be put in a crucible together with liver of sulphur, and it be melted in a brisk fire, the gold is thoroughly dissolved; and if the whole be diluted in water, the gold will be kept in the solution, and even pass through the filtre along with it.

(K) Antimony is used also to refine gold from its alloy, as it attenuates and carries off all other metallic substances

Perfect Metals. Gold.

11. The phosphorus is said to have ingress into gold (L).

12. If mixed with a less portion of silver, platina, copper, iron, and zinc, it preserves tolerably well its ductility. But,

13. When mixed with tin, it becomes very brittle; and it attracts likewise the smoke of that metal, so as to be spoiled if melted in an hearth where tin has been lately melted (M).

14. It requires a strong heat before it melts, nearly as much or a little more than copper.

15. It mixes or amalgamates readily with quicksilver. See METALLURGY, Part II. sect. i. (N).

16. It is not dissolved by the glass of lead, and therefore remains on the cupel.

A. Native gold. With respect to the figure or the quantity in which gold is found in one place, it is by miners divided into,

1. Thin superficial plated or leaved gold; which consists of very thin plates or leaves, like paper.
2. Solid or massive, is found in form of thick pieces.
3. Crystallised, consists of an angular figure.
4. Wash gold, or gold dust, is washed out of sands, wherein it lies in form of loose grains and lumps (O). See other distinctions of form under the article GOLD.

B. Mineralised gold. This is an ore in which the gold is so far mineralised, or so entangled in other bodies, as not to be dissolved by the aqua-regia.

1. Mineralised with sulphur by means of iron. Marcasitical gold-ore; *Pyrites aureus*.
2. By means of quicksilver. It is found in Hungary.
3. By means of zinc and iron, or silver. The Schemnitz blende.

See other varieties of mineralised gold ores under the detached article GOLD, already referred to.

Perfect Metals. Silver.

II. Silver: *Argentum*, *Luna*. See the article SILVER. See also CHEMISTRY-*Index*; and METALLURGY, Part II. sect. iii. and Part III. sect. iii.

This metal is,

a. Of a white shining colour.

b. Its specific gravity to water is, according to Cronstedt, as 11,091 to 1000; according to Bergman, = 10,552; and according to Kirwan, 11,095.

c. It is very tough or ductile, so that a grain of it may be stretched out to three yards in length and two inches in breadth.

d. It is unalterable in air, water, and fire.

e. It dissolves in the acid of nitre, and also by boiling in the acid of vitriol.

f. If precipitated out of the acid nitre with the common salt, or with its acid, it unites so strongly with this last acid, that it does not part from it, even in the fire itself, but melts with it into a mass like glass, which is called *luna cornea* (P).

substances mixed with it, without excepting the silver; whilst lead leaves this last behind, and even adds some of its own to the gold. *Paucton*, p. 659.

(L) Gold, reduced into thin leaves, is not acted upon by the phosphoric acid in the humid way, though the fire be urged till luminous decrepitations take place; but when it passes that point which separates the humid from the dry way, Mr Margraaf observed that some purple scoria were formed, which is an indication that this concrete acid had partly calcined the gold during its fusion. *Elements de Chymie de Dijon*, Vol. III. p. 131.

Besides this, a drop of the phosphoric acid on the solution of gold by aqua-regia precipitates the metal in its revived state, as asserted by the academicians of Dijon. *Magellan*.

(M) The fumes of a single grain of tin are capable of rendering hard eight ounces of gold; but it easily recovers its malleability by being melted on the fire. (*Wallerius* and *Bomare's* Mineralogy.) But when gold is mixed with arsenic, cobalt, nickle, bismuth, or with the regulus of antimony, it only loses great part of its malleability; and when in a certain proportion, it may be calcined and vitrified with them.—(*Fabroni.*)

(N) Bergman doubts if ever gold has been found perfectly pure; and Mr Kirwan says that it is very seldom found so, being generally alloyed with silver, copper, or iron, or all three. As to the gold commonly used in toys and other objects of luxury, every one knows that it is purposely debased by the artists with copper or other metals; and of late it has been employed in various pieces of jewellery, to form ornaments of various colours: thus a great alloy of silver (viz. one-third part), gives it a shade of a green colour; a similar quantity of copper, a reddish one; a mixture of arsenic, or filings of steel, in the proportion of one-fourth part, gives it a bluish cast; so that having the yellow naturally in the pure gold, and the white in pure silver, the jewellers have almost all the colours to diversify their work. Even in the currency of money, there is none coined out of pure gold, which, by common agreement, is called *gold of 24 carats*. The gold coin of England, France, and Portugal, only contains 22 parts of pure gold, and two of alloy, viz. it is only 22 carats, in the common saying: that of Spain is but of $21\frac{7}{12}$ carats: but the ducat of Holland is of $23\frac{7}{12}$ carats; and the zecchino of Venice, of $23\frac{3}{4}$ carats: which last therefore, it would seem, is the purest gold coin of Europe. (*Paucton's Metrologie.*)

(O) M. Daubenton, in his Methodical Tables of Minerals, enumerates eight sorts of native gold, viz. 1. In powder; 2. In grains; 3. In small spangles; 4. In masses of lumps; 5. In filaments; 6. In branches like vegetables; 7. In lamella; and 8. In octoedral crystals.—He observes also, that gold, in its reguline state, is formed, either, 1. Into angular crystals, composed of yellow octoedres; or, 2. Into irregular yellow masses, which, being broken, show a granular substance.

(P) The marine acid attracts the calx of silver, but cannot remove its phlogiston; and therefore cannot dissolve

g. It does not unite with the femi-metal nickel during the fufion.

h. It amalgamates eafily with quickfilver.

i. It is in the dry way diffolved by the liver of fulphur.

k. It has a ftrong attraction to fulphur, fo as readily to take a reddifh yellow or black colour when it is expofed to liver vapours.

l. It has no attraction to arfenic; whence, when the red arfenical filver ore, or *rothgulden ertz* of the Germans, is put into the fire, the arfenic flies off, and leaves the fulphur (which in this compound was the *medium uniens*, behind, united with the filver in form of the glafs filver ore, or glafs ertz.

m. It is not diffolved by the glafs of lead, and confequently it remains on the cupel.

n. It is exhaled or carried off by volatile metals and acids; as by the vapours of antimony, zinc, and the acid of common falt.

o. According to Cronftedt, it melts more eafily than copper; and this was a general opinion. But the contrary, as Mr Magellan remarks, has been proved by means of the nice thermometer lately invented by Wedgewood.—See Thermometer.

Silver is found,

A. Native or pure; which moft generally is nearly of 16 carats ftandard (q)

1. Thin, fuperficial, plated or leaved.
2. In form,
   - *a*. Of fnaggs, and coarfe fibres.
   - *b*. Of fine fibres. Capillary filver.
   - *c*. Arborefcent.
   - *d*. Cryftalline or figured. This is very rare: it has diftinct fibres, with fhining furfaces.

B. Mixed or alloyed with other metals.

The following are the known inftances of thefe mixtures:

1. United to gold, (*Bergman's Sciagraphia*, § 154.)
2. Mixed with copper; (*Berg. Sc* § 155.)
3. United to gold and copper; (*Berg. Sc.* § 156.)
4. Amalgamated with mercury, found in the mines of Salberg; (*Fofter's notes to Brunnich.*)
5. United to iron; (*Berg. Sc.* § 157.)
6. United to lead, fometimes in fuch quantities as to be worth the expences attending the feparation.
7. United to arfenic; (*Journal de phyfique*, 1778, p. 50.)
8. United to antimony; (*Berg. Sc.* § 159.)
9. Joined to the regulus of arfenic and iron; (*Berg. Sc.* § 160.)
10. Mixed with the alkaline limeftone from Annaberg, defcribed by Mr Jufti; (*Brunnich.*)
11. Sandy filver-ore, without any metallic fhining.
12. Silver-ore in a red-brown fchiftus, defcribed by Lehman: it is compofed of argillaceous earth, micaceous hematites, fulphur, calcareous fpar, fluor mineralis, lead, and filver.—It contains about feven or eight ounces of filver on the hundred weight.
13. Soft filver-ore. It is found among the marles and argillaceous earths; and is of various colours, either fingly or mixed.

C. Diffolved and mineralifed.

(1.) With fulphur alone. Glafs filver-ore.

This is ductile, and of the fame colour as lead; but, however, becomes blacker in the air. It has therefore, though very impoperly, got the name of *glafs-ore*; for that name rather belongs to the *minera argenti cornea*, or horn filver ore, if indeed any filver ore can be confidered as glaffy.

It is found,

1. In crufts, plates, or leaves.
2. Grown into
   - *a*. Snaggs, and
   - *b*. Cryftalline figures.

   It is generally either of a lamellar or a grained texture.

The glafs filver ore is the richeft of all filver ores; fince the fulphur, which is united with the filver in this ore, makes but a very fmall quantity of its weight.

(2.) Arfenico-martial filver ore, (*Weill ertz*, Germ.)

This ore contains filver and iron mineralifed by arfenic; the arfenic in a larger proportion than the iron. This is the *Pyrites argenteus* of Henckel.

1. It is a hard fubftance, of a white fhining appearance, and of a compact, lamellar, or fibrous texture. (*Kirwan*, fp. 7.)
2. Of a yellowifh white colour, and of a friated ftructure, refembling bifmuth, but much harder. (*Kirwan*, fp. 3.)—It is found near Guadanal canal in Spain.
3. Near the fame place is found alfo another ore of the fame kind, which is very foft and eafily cut; and when cut, has a brilliant metallic appearance. It confifts of conchoidal laminæ. The quintal contains only from four to fix ounces of filver; but it is eafily reduced by evaporating the arfenic, which then leaves the filver flightly contaminated with iron. (*Kirwan*, fp. 4.)

(3.) With

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diffolve it in its metallic ftate, (*Bergman.*) However, the marine acid, if well concentrated, or rather reduced into an aerial form, diffolves filver in its metallic ftate, (*Fabroni.*)

Mr Scheele, and after him Mr Bertholet, affert pofitively, that the marine acid, being dephlogifticated by its diftillation over maganefe in the form of a yellow air or gas, diffolves all the metals, without excepting gold, filver, or mercury. See Scheele's Effay 5. § 25. H.

The vitriolic acid being diftilled alfo over the maganefe, diffolves filver, gold, and mercury, as Dr Crell afferts, (*Journal de Phyfique*, Oct. 1785, p. 297.)

Silver is precipitated from the vitriolic and nitrous acids by the marine; and from the nitrous, in great meafure, by the vitriolic, (*Kirwan.*)

(q) Wallerius diftinguifhes feven fpecies of filver: (fee the article Silver). Daubenton reckons eight varieties of *native white filver*, arifing from their peculiar forms.

Perfect METALS. *Silver.*

(3.) With sulphur and arsenic. The red or ruby-like silver ore. The *rothgulden* of the Germans.

The colour of this ore varies as the proportion of the ingredients varies in the mixture, viz. from dark grey to deep red; but when it is rubbed or pounded, it always gives a red colour.

a. Grey arsenical silver ore.

1. Plated, crusted, or leaved.
2. Solid.

b. The red arsenical silver ore:

1. Plated, crusted, or leaved;
2. Solid or scaly.
3. Crystallised (R.)

In this last form it shows the most beautiful red colour, and is often semitransparent. It contains about 60 *per cent.* in silver.

(4.) With sulphur, little arsenic, and iron.—(*Schwartz ertz, Schwartz gulden, Silber mulm.* Germ.)

This is a friable, weathered, decayed ore.

a. Of a black or sooty colour; and is therefore called by the Germans *silberschwartz*, or *russigtes-ertz.*

(5.) With sulphurated arsenic and copper. The *weissgulden* of the Germans.

This, in its solid form, is of a light grey colour, and of a dull and steel-grained texture. Its proportion of silver is from 10 to 30 *per cent.*

(6.) With sulphurated arsenic and iron. The *weisertz*, or white silver ore of the Germans.

This is an arsenical pyrites, which contains silver; it occurs in the Saxon mines, and so exactly resembles the common arsenical pyrites, as not to be distinguished from it by sight alone, or without other means.

(7.) With sulphurated antimony.

a. Of a dark grey and somewhat brownish colour; the *laberetz* of the Germans.

b. Of a blackish blue colour.

1. In form of capillary crystals. *Federertz*, or plumose silver ore.

(8.) With iron, arsenic, and cobalt, mineralised by sulphur.

This ore looks like the *weissgulden* described above; but is distinguished by the rose coloured particles of cobalt, dispersed through dark brown, blackish, or grey, and sometimes shining solid mass. It is to this species of ores that the silver goose dung ore belongs.

(9.) With sulphurated copper and antimony.—The Dal *fah-lertz.*

This resembles both in colour and texture the dark-coloured weissgulden. When rubbed, it gives a red powder.

Perfect METALS. *Platina.*

a. Solid.

b. Crystallised.

(10.) With sulphurated zinc. The *pechblende* of the Germans.

This is a zinc ore, mock lead, or blende, which contains silver, and is found among rich silver and gold ores.

a. Of a metallic changeable colour.

1. Solid, and with fine scales.
2. In form of balls. The *kugel-ertz*, or ball ore.

b. Black mock lead, or blende, found in Saxony. This is also found,

1. Solid, and with fine scales;
2. And in form of balls.

(11.) With sulphurated lead; potters ore. *Galena; bleyglanz.*

(12.) With sulphurated lead and antimony, called *striperz.*

(13.) With sulphurated iron. *Silberhalitgier kies;* marcasite holding silver.

(14.) With sulphurated and arsenical cobalt; dendrites being sometimes found in the stone.

These kinds keep well in water; but generally wither in the air, and lose the silver they contain.

(15.) Mineralized by sulphur, with regulus of antimony and barytes. The butter-milk ore.

This is found in the form of thin particles, on granular spar, (*Kirwan*, sp. 13.)

(16.) Combustible silver ore.

This is a black and brittle substance, and leave about 6 per cent. of silver in its ashes. It is in fact a coal in which silver is found. (*Kirwan*, sp. 14.)

(17.) With the acid of common salt. *Minera argenti cornea. Hornetz*, or horn-silver ore.

This is the scarcest silver ore; it is of a white or pearl colour, changeable or varying on the surface, semi-transparent, and somewhat ductile both when crude and when melted. It cannot be decomposed without some admixture of such substances as attract the acid of sea-salt.

III. Platina del Pinto; *Juan blanca.*

This metal is a recent discovery of our times; and is described with great accuracy by Scheffer, in the Acts of the Royal Academy of Sciences at Stockholm for the year 1752; as also by Dr Lewis, in the Philosophical Transactions for the year 1754, vol. xlviii. and by many other writers. By these descriptions we are convinced of the resemblance this metal bears to gold; and therefore we must allow it to be called *white gold.* It has, however, a variety of distinguishing qualities

P 2

(R) Wallerius mentions the six following varieties of this notable ore in his *Species* 388, viz. 1. The red opaque, like cinnabar, from Andreasberg in the Hartz, and from Salberg in Westmannia: 2. The bluish, from Freiberg and Annaberg: 3. The grey, from Freiberg and Andreasberg: 4. The red transparent amorphous, of the garnet colour, from Potosi and Ioachimstal: 5. The red transparent, crystallised into prismatic decaedres, or dodecaedres, from Hungary, Alsace, and the Duchy of Deuxponts: 6. The only superficially red ore, from Salberg and Ehrenfriederichsdorf.

Perfect METALS. *Quickſilver.*

lities beſides its colour, which aſcertain its peculiar nature : All which, with its hiſtory, uſes, &c. are particularly deſcribed under the detached article PLATINA. See alſo CHEMISTRY-*Index;* and METALLURGY, Part II. ſect. ii.

1. It is of a white colour.
2. It is ſo refractory in the fire, that there is no degree of heat yet found by which it can be brought into fuſion by itſelf, the burning-glaſs excepted. But, when mixed with other metals and ſemimetals, it melts very eaſily, and eſpecially with arſenic, both in its metallic form and in form of a calx or glaſs.

IV. Quickſilver, mercury. *Hydrargyrum, Argentum vivum, Mercurius.* See the article QUICKSILVER; CHEMISTRY-*Index*, at *Mercury;* and METALLURGY, Part II. ſect. viii.

Mercury diſtinguiſhes itſelf from all metals by the following qualities (S.)

a. Its colour is white and ſhining, a little darker than that of ſilver.

b. It is fluid in the cold, and diviſible by the leaſt force ; but, as it only ſticks to a few bodies to which it has an attraction, it is ſaid that it does not wet.

c. It is volatile in the fire.

d. It attracts the other ſemimetals and metals ; and unites with them all except cobalt and nickel, with which it cannot by any means yet known be made to mix. This union is called *amalgamation.* This amalgamation, or mixtion of metallic bodies, according to the readineſs with which they unite or mix, is in the following progreſſion, viz. gold, ſilver, lead, tin, zink, biſmuth, copper, iron, and the regulus of antimony ; the three latter, however, do not very readily amalgamate. The iron requires a ſolution of the vitriol of iron, as a medium to promote the union.

e. It diſſolves in ſpirit of nitre, out of which it is precipitated by a volatile alkali, and common ſalt, in form of a white powder ; but if a fixed alkali is uſed, a yellow powder or calx is obtained (T).

f. But

(S) It were almoſt ſuperfluous, ſays Mr Kirwan, to mention any other character of quickſilver than its liquidity, to diſtinguiſh it from other metals. In regard to this property, Bergman obſerves, that mercury conſtitutes one extreme among the metals, and platina the other ; ſince it requires to be melted only ſuch a degree of heat as is rarely wanting in our atmoſphere, and boils at the 6000 degrees nearly after lead melts. See the table at p. 111. *Note.* But when the cold is increaſed to the temperature denoted by 40 degrees below 0 both of Fahrenheit's and of the Swediſh thermometer, which both coincide in that point (ſince 212—32, or 180 : 100 : : 32+40, or 72 : 40), this metal concretes like any other metal, and becomes quite ſolid ; (ſee Philoſophical Tranſactions for 1783, p. 303.) Mercury in its common ſtate, therefore, according to Bergman (Treatiſe of *Elect. Attract.*), is to be conſidered as a metal in fuſion : and ſince in its ſolid ſtate it is nearly as malleable as lead, it by no means ought to be placed among the ſemimetals, otherwiſe every other entire metal ſhould be conſidered as brittle, for none is malleable when in fuſion.

(T) 1. Mercury is diſſolved with great rapidity by nitrous acid : the liquor is of a greeniſh-blue colour, but loſes it afterwards and becomes limpid. This ſolution, when made without heat, is uſed as a teſt for the analyſis of mineral waters, and has different properties from that made with the help of heat. In the firſt caſe, ſays Bergman, very little phlogiſton is loſt, and the ſalt eaſily cryſtalliſes, being white, and ſcarcely acrid. It is not precipitated by diſtilled water ; but by cauſtic vegetable alkali, it is precipitated of a yellowiſh colour ; by mild alkali, the precipitation is white ; by mineral alkali, it is yellow, but it ſoon grows alſo white ; by volatile alkali, it turns to a greyiſh-black colour ; by Glauber's ſalt, or by pure vitriolic acid, the precipitation is white, granulated, and in a ſmall quantity ; nor, if this precipitant has been ſparingly uſed, does this colour appear in leſs than an hour : by muriatic acid, or common ſalt, the precipitation is alſo white, but in a large quantity, and in curdles.

2. But if the mercurial ſolution be put over a ſand-heat, it may be charged with a quantity of mercury equal almoſt to its weight. According to the chemiſts of Dijon, 10 ounces of nitrous acid may diſſolve eight of mercury. The action of the ſolvent becomes ſtronger with the heat ; emits great quantity of vapours ; and if not taken from the fire, will be too far evaporated. Diſtilled water will precipitate from this ſolution a white calx, becauſe it is more dephlogiſticated, and the ſolvent is overcharged with it ; and the water changing the denſity of the liquor, diminiſhes the adheſion of the calx, as Fourcroy remarks. This white calx will turn yellow, if boiling water be poured on it. The vegetable alkali precipitates it of a browniſh yellow, which by degrees aſſumes a pale-yellow tinge : the mild vegetable, and the mineral alkalies, produce nearly the ſame colour ; though when this laſt is employed, the colour turns afterwards to white. The precipitation by volatile alkali is quite white alſo ; that by the vitriolic acid is yellow ; and, finally, a copious white mucilaginous matter is the precipitate by the marine acid.

3. This ſolution by nitrous acid is very cauſtic ; corrodes and deſtroys animal ſubſtances ; when it falls on the ſkin, ſtains it it of a deep purple brown colour, which appears black : the ſtains do not go off before the ſeparation of the epidermis, which falls away in ſcales or kind of ſcars. It is uſed in ſurgery as a powerful eſcharotic, and is called *mercurial water.*

4. The ſame ſolution, by cooling, is ſuſceptible of forming cryſtals, which vary from one another according to circumſtances: for the moſt part they are like needles ; are very cauſtic ; redden the ſkin ; and detonate when put on burning coals, provided they be dry. They are called *mercurial nitre*, which fuſes when heated in a crucible ; exhales reddiſh fumes ; aſſumes a deep yellow colour, which afterwards turns to orange, and

Perfect Metals. Quickſilver.

f. But it requires a boiling heat to diſſolve it in oil of vitriol (U).

g. It is not affected by the acid of common ſalt, unleſs it be previouſly diſſolved by other acids (V); in which caſe only they both unite with one another, and may be ſublimed together; this ſublimate is a ſtrong poiſon.

h. It unites with ſulphur by grinding; and then produces a black powder called *æthiops mineralis* (W), which ſublimes into a red ſtriated body called *factitious cinnabar*.

i. The ſulphur is again ſeparated from the quickſilver, by adding iron or lime, to which the ſulphur attaches itſelf, leaving the quickſilver to be diſtilled over in a metallic form; but if a fixed alkali be uſed, ſome part of the quickſilver will remain diſſolved in the reſiduum, which is a liver of ſulphur.

Quickſilver is found,

A. Native, or in a metallic ſtate. *Mercurius nativus*, or *virgineous*.

This found in the quickſilver mines at Idra in Friuli, or the Lower Auſtria, in clay, or in a black ſlaty *lapis ollaris*, out of which it runs, either ſpontaneouſly, or by being warmed even in the hands.

B. United to gold or ſilver. *Hydrargyrum argento vel auro adunatum*.

Mr Kirwan aſſerts, on the authorities of Monet and Lin. Von Gmelin, that in Sweden and Germany mercury has been found united to ſilver in the form of a ſomewhat hard and brittle amalgam.

Romé de l'Iſle had a ſpecimen of this natural amalgam from Germany, which is imbedded in a quartzoſe maſs, and mixed with cinnabar, as Mr Mongez aſſerts; and he adds, that in the royal cabinet, at the king's garden at Paris, is depoſited another fine ſpecimen of this mercurial ore, which was found cryſtalliſed in the mine called *Carolina* at Muchel-lanſberg in the duchy of Deux Ponts. M. de l'Iſle ſpeaks alſo very poſitively of a ſpecimen of native gold from Hungary, which ſeems to be a natural amalgam of gold and mercury. It is compoſed of quadrangular priſms, of a greyiſh yellow colour, and of a brittle texture. This ſpecimen is alſo in the king's cabinet at the royal garden at Paris.

Mr Kirwan, ſpeaking of the method of examining the purity of gold by the moiſt way, ſuppoſes, with Sir Torbern Bergman, that there are natural amalgamations of mercury with gold and ſilver: and Neumann obſerves, that ſometimes a mineral, containing gold or ſilver, is met with among mercurial ores, although this is a great rarity.

It is evident, therefore, that there naturally exiſt

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and at laſt to a brilliant red: in this ſtate it is called *red precipitate*, or *arcanum corallinum*. It muſt be made in a matraſs with a gentle heat if it is deſigned to be corroſive for chirurgical purpoſes.

(U) 1. The vitriolic acid, concentrated and boiling hot, ſeizes on mercury, and preſently reduces it if urged by heat to a kind of white powder, which turns yellow by the affuſion of hot water, but does not diſſolve in it; this is called *turbith mineral:* but if cold water, inſtead of hot, was poured in the white maſs, the powder would not change its white colour into yellow as was ſaid above about the nitrous ſolution.

2. If Mercury be rarefied by heat into vapours, and theſe meet with thoſe of marine acid in the ſame ſtate, a corroſive ſublimate will be formed. This metallic ſalt ſhoots into cryſtals pointed like daggers, which are the ſtrongeſt of all poiſons. But there are various other proceſſes found in chemical authors to make this ſalt with more or leſs trouble. See Chemistry, n° 814—818.

3. If corroſive ſublimate be mixed with tin and diſtilled, a very ſmoking liquor is produced, called by the name of its inventor the *ſmoking liquor of Libavius*. See Chemistry, n° 810.

The muriatic acid in the ſublimate is not ſaturated, and from hence proceeds its great corroſive power; for if a freſh quantity of mercury be added to it, and ſublimed a ſecond or third time, a ſweet, or mixed ſublimate, called *mercurius dulcis*, is produced, which is not poiſonous, and is given internally as a purgative, or an emetic, according to the doſe. See Chemistry, n° 819.

(V) Muriatic acid does not act upon quickſilver unleſs this laſt be previouſly deprived of as much phlogiſton, as $\frac{74}{100}$ of the quantity contained in the hundred of ſilver, or of $\frac{80}{182}$ in the hundred of zinc. (See Bergman's *Sciagraphia*, and his treatiſe *De Phlogiſti quantitate.)*

(W) The academicians of Dijon ſay, that the true proportion to make this æthiops, is that of one part of brimſtone with four of mercury. Fourcroy directs only one of mercury, with three of flowers of ſulphur, to be triturated, till the mercury is extinguiſhed. A black powder is then produced, which is the æthiops mineral. The combination is better effected when the mercury is mixed with the fuſed ſulphur: by agitating this mixture, it becomes black, and eaſily takes fire; it ſhould be then taken from the fire, and the flame ſhould be extinguiſhed a little after, ſtirring the maſs till it becomes into ſolid clots. If this ſubſtance be expoſed to a great degree of heat, it takes fire, the ſulphur is conſumed, and a ſubſtance remains which is of a violet colour when pulveriſed. This powder being put into matraſſes, till their bottom become red by the force of fire, is ſublimed after ſome hours, and artificial cinnabar is found in the top of the veſſels cryſtalliſed into brown red needles.

Mercury, divided by means of a rapid and continual motion, as that of a mill-wheel, gradually changes itſelf into a very fine black powder, which is called *æthiops per ſe*, on account of its colour, in order to diſtinguiſh it from this *æthiops mineralis* mentioned in the text.

Perfect Metals. *Quickfilver.*

ift various ores of quickfilver, amalgamated with filver, gold, and other minerals, although they be but feldom met with.

C. Mineralifed,

[1.] With fulphur.

A. Pure cinnabar, *Cinnabaris nativa.*

a. Loofe or friable cinnabar like red ochre.

b. Indurated or folid cinnabar. It is of a deep red colour; and, with refpect to its texture, is either,

1. Steel-grained;
2. Radiated;
3. Compofed of fmall cubes, or fcaly; or
4. Cryftallifed, in a cubical form; it is tranfparent, and deep red like a ruby.

B. Impure cinnabars.

1.) A mercurial ore is found in Idria, fays Gellert, where the mercury lies in an earth or ftone, as if it were in a dead form; and has the appearance of a red-brown iron-ftone; but it is much heavier than that. It contains from three quarters to feven eighths of the pureft mercury; leaves, after diftillation, a very black ftrong earth behind; and gives fome marks of cinnabar.

2.) Liver ore, which is moft common in Idria, and has its name from its colour.—Outwardly it refembles an indurated iron-clay; but its weight difcovers that its contents are metallic. It yields fometimes 80 pounds of quickfilver per hundred weight.

3.) Burning ore; *brand-erz* in German. This ore may be lighted at the candle; and yields from nine to 50 pounds of quickfilver per hundred weight. *Brunnich.*

[2.] With iron by fulphur. Pyritous cinnabar. Sir Torbern Bergman inferted this ore in the 177th fection of his *Sciagraphia*, and feems doubtful whether this be a diftinct fpecies from the cinnabar; as the iron is perhaps, fays he, only mechanically diffufed therein. Mr Mongez remarks, that there are but a few inftances of cinnabar in which iron is not found in its calcined form; though, in the act of the ore being reduced, it paffes to its metallic ftate, and becomes capable of being acted on by the loadftone.

Another pyritous ore of cinnabar was found at Menidot, near St Lo in Lower Normandy. It confifted in grains of different fizes, of a red brown colour: they had a vitriolic tafte and fulphureous fmell. Found alfo at Almaden in Spain, and at Stahlberg in the Palatinate; though at this laft place they are of a dodecaedral form.

Imperfect Metals. *Tin.*

[3.] With filver by the aerial acid, and fulphur.

This feems to be a native precipitate *per fe*, or calx of mercury. It is faid to have been lately found in Idria, in hard compact maffes of a brownifh-red colour; fee *Journal de Phyfique* for January 1784, p. 61. If this account can be relied upon, it will prove, that quickfilver, even in a calciform ftate, is naturally found mineralifed with filver by means of fulphur.

[4.] With fulphur and copper.

This ore is blackifh grey, of a glaffy texture, and brittle; crackles and fplits exceffively in the fire; and when the quickfilver and fulphur are evaporated, the copper is difcovered by its common opaque red colour in the glafs of borax, which, when farther forced in the fire, or diluted, becomes green and tranfparent. It is found at Mufchlanfberg in the duchy of Deux Ponts.

[5.] Mineralifed by the marine and vitriolic acids.

Mineralogy owes the difcovery of this ore to Mr Woulfe, who publifhed an account of it in the Philofophical Tranfactions for 1776. It was found in the duchy of Deux Ponts, at the mine diftinguifhed by the name of *Obermofchal.* It had a fpar-like appearance. This ore is either bright and white, or yellow or black. It was mixed with cinnabar in a ftony matrix; and being well mixed with one-third of its weight of vegetable alkali, afforded cubic and octagonal cryftals; that is, falt of Sylvius and vitriolated tartar.

The marine falt of this mercury is in the ftate of fublimate corrofive.

Order II. Imperfect or base Metals.

I. Tin. *Stannum; Jupiter.* (See the detached article Tin: Alfo Chemistry-*Index;* and Metallurgy, Part II. fect. vi. and Part III. fect. vi.)

This is diftinguifhed from the other metals by the following characters and qualities. It is,

a. Of a white colour, which verges more to the blue than that of filver.

b. It is the moft fufible of all metals; and,

c. The leaft ductile; that is, it cannot be extended or hammered out fo much as the others (x).

d. In

(x) Tin is fufficiently ductile to be beaten into very thin leaves. But ductility and extenfibility are two different properties, lefs connected with one another than is generally imagined. Iron and fteel are drawn into exquifite fine wire, but cannot be beat into very thin leaves. Tin, on the other hand, is beat into fine leaves, and may be exended between rollers to a confiderable furface. The tin-fheet ufed in various arts, is commonly about $\frac{1}{300}$th part of an inch; but may be extended twice as much in its dimenfions without difficulty. Notwithftanding this extenfibility, tin cannot be drawn into wire, on account of the weak cohefion of its particles. A tin wire, however, of one-tenth of an inch diameter, is able to fupport a weight of $49\frac{1}{2}$ pounds, according to Fourcroy. Gold and filver poffefs both properties of ductility and extenfibility the moft eminently of all metallic bodies; whilft lead, notwithftanding its flexibility and foftnefs, cannot be made either into leaves or wire of any finenefs.

d. In breaking or bending, it makes a crackling noife.

e. It has a fmell particular to itfelf, and which cannot be defcribed.

f. In the fire it is eafily calcined to white afhes, which are 25 per cent. heavier than the metal itfelf. During this operation, the phlogifton is feen to burn off in form of fmall fparkles among the afhes or calx.

g. This calx is very refractory; but may, however, with a very ftrong degree of heat be brought to a glafs of the colour of colophony. But this calx is eafily mixed in glafs compofitions, and makes with them the white enamel.

h. It unites with all metals and femimetals; but renders moft of them very brittle, except lead, bifmuth, and zinc.

i. It amalgamates eafily with quickfilver.

k. It diffolves in aqua-regia, the fpirit of fea-falt, and the vitriolic acid; but is only corroded into a white powder by the fpirit of nitre. The vegetable acid, foaps, and pure alkaline falts, alfo corrode this metal by degrees

l. Its fpecific gravity to water is as 7400 to 1000, or as 7321 to 1000.

m. Diffolved in aqua-regia, which for this purpofe ought to confift of equal parts of the fpirit of nitre and fea-falt, it heightens the colour of the cochineal, and makes it deeper; for otherwife that dye would be violet.

(1.) Native Tin.

The exiftence of native tin has long been queftioned: but it has undoubtedly been found fome years ago in Cornwall, as Mr Kirwan remarks.

1. Malleable tin, in a granular form, and alfo in a foliaceous fhape, iffuing out of a white hard matter like quartz: but which, after being properly affayed, proved to be arfenical cryftals; a circumftance that evinces its being native tin, fince the arfenic could not remain in this form if the tin had been melted. It appeared like a thick, jagged, or fcolloped lace or edging; and was found near St Auftle in Cornwall.

2. In the form of cryftalline metallic laminæ, or laminated cryftals, rifing fide by fide out of an edging, which fhone like melted tin: they were almoft as thin as flakes or fcales of talc, interfecting each other in various directions, with fome cavities between them, within which appeared many fpecks and granules of tin, that could be eafily cut with a knife: this was alfo found in Cornwall.

3. In a maffy form, more than one inch thick in fome places, and inclofed in a kind of quartzous ftone; or rather in an hard cruft of cryftallifed arfenic.

(2.) Calciform Ores of Tin.

A. In form of a calx, *Stannum calciforme.*

A. Indurated, or vitrified.

1. Mixed with a fmall portion of the calx of arfenic.

a. Solid tin ore, without any determinate figure. Tin-ftone.

It refembles a garnet of a blackifh brown colour, but is much heavier; and has been confidered at the Englifh tin-mines as a ftone containing no metal, until fome years ago it began to be fmelted to great advantage.

B. Cryftallifed.

a. Tin fpar, or white tin ore. This is generally of a whitifh or grey colour; fometimes it is yellowifh, femi-tranfparent, and cryftallifed; either of a pyramidical form, or irregularly.

b. Tin-grains. This ore, like the garnets, is of a fpherical polygonal figure; but feems more unctuous on its furface.

1. In large grains.
2. In fmall grains.

B. Mixed with metals.

1. With the calx of iron, as in the garnet.
2. With manganefe. See the *Semimetals.*

C. Mineralifed.

1. With fulphur and iron.
2. With fulphur. *Aurum mufivum.*

This was difcovered by Profeffor Bergman, among fome minerals which he received from Siberia. He obferved two forts of it, analogous to the two artificial combinations of tin with fulphur.

1. One nearly of the colour of zinc, and of a fibrous texture, which contained about 20 *per cent.* of fulphur, and the remainder tin.
2. The other enveloped the former like a cruft; refembled aurum mufivum; and contained about 40 *per cent* of fulphur, a fmall proportion of copper, and the remainder tin. *Mem. Stockh.* for 1721, p. 328.

At Huel Rock, in St Agnes in Cornwall, there has been found a metallic vein, nine feet wide, at 20 yards beneath the furface. Mr Rafpe was the firft who difcovered this to be a fulphurated tin-ore: it is very compact, of a bluifh white colour, approaching to grey fteel, and fimilar to the colour of grey copper ore: it is lamellar in its texture, and very brittle. It confifts of fulphur, tin, copper, and fome iron. Mr Rafpe propofes to call it *bell-metal ore.*

According to Mr Klaproth's analyfis of this ore, 119 grains contain 30 of pure fulphur; 41 of tin; 43 of copper; two of iron; and three grains of the ftony matrix. In another fpecimen of the fame fulphurated tin-ore from Cornwall, there were in the hundred 25 parts of fulphur, 34 of tin, 36 of copper, three of iron, and two of the ftony matrix.

II. Lead; *Plumbum, Saturnus.* (See the article LEAD, and CHEMISTRY-*Index*: Alfo METALLURGY, Part II. fect. v. and Part III. fect. vii.)

The

The properties of lead are as follows.

a. It is of a bluish white colour when fresh broke, but soon dulls or sullies in the air.

b. It is very heavy; viz. to water as 11,325 to 1000.

c. It is the softest metal next to gold; but it has no great tenacity, and is not in the least sonorous.

d. It is easily calcined; and, by a certain art in managing the degrees of the fire, its calx becomes white, yellow, and red.

e. This calx melts easier than any other metallic calx to a glass, which becomes of a yellow colour, and semitransparent. This glass brings other bodies, and the imperfect metals, into fusion with it.

f. It dissolves, 1st, In the spirit of nitre; 2dly, In a diluted oil of vitriol, by way of digestion; 3dly, In the vegetable acid; 4thly, In alkaline solutions; and 5thly, In expressed oils, both in the form of metal and of calx.

g. It gives a sweet taste to all solutions.

h. It amalgamates with quicksilver.

i. With the spirit of sea-salt it has the same effect as silver, whereby is produced a *saturnus corneus*.

k. It does not unite with iron, when it is alone added to it in the fire.

l. It works on the cupel, which signifies that its glass enters into certain porous bodies, destitute of phlogiston and alkaline salts.

m. It melts in the fire before it is made red-hot, almost as easily as the tin.

n. Its calx or glass may be reduced to its metallic state by pot-ashes.

[1.] Native Lead.

For proofs of lead being naturally found in its metallic state, see the article Lead.—It may be here added, that Henckel likewise affirms its existence, in his *Flora Saturnisans*; (see Kirwan's *Elements of Mineralogy*, p. 297, 298.) Wallerius asserts, that it has been so found in Poland, a specimen of which was kept in the collection of Richter; and adds, that a similar one found at Schneberg, was seen in the collection of Spener. (*Mineralogy*, vol. ii. p. 301.)

Dr Lawson, in his English edition of Cramer's Art of Essaying Metals, says, that some pure native malleable lead had been lately found in New England; (p. 147.) And lastly, Professor Bergman did not hesitate to insert, by itself alone, the *plumbum nativum*, in Sect. 180. of his *Sciagraphia*.

[2.] Calciform Lead.

Lead is found,

A. In the form of a calx.

A. Pure.

a. Friable lead ochre, native ceruse.

b. Indurated lead spar, or spatose lead ore.

i. Radiated, or fibrous.

1. White, from Mendip-hills, in England.

ii. Crystallised in a prismatic figure.

1. White, from Norrgrufva in Westmanland.

2. Yellowish green, from Zchopau in Saxony.

B. Mixed,

1. With the calx of arsenic, arsenical lead spar.

2. Indurated.

a. White. Mr Cronstedt has tried such an ore from an unknown place in Germany, and found that no metallic lead could be melted from it by means of the blow-pipe, as can be done out of other lead spars; but it must be performed in a crucible. (See the article Lead. par. iii.)

3. With a calcareous earth.

This ore effervesces with aqua-fortis, and contains 40 *per cent.* of lead; on which account is is placed here rather than among the calcareous earths.

B. Mineralised.

1. With sulphur alone: the *bley-schweiff*, or *bley-glanz*, of the Germans.

a. Steel-grained lead-ore.

b. Radiated, or antimoniated lead-ore.

c. Tessellated, or potter's lead-ore.

At Villach in Austria there is said to be found a potter's lead-ore, which contains not the least portion of silver.

2. Mineralised by the vitriolic acid.

This ore was discovered by Mr Monnet. It occurs sometimes, though rarely, in the form of a white ponderous calx; and seems to originate from the spontaneous decomposition of the sulphurated lead-ores above mentioned.

3. By the acid of phosphorus.

This ore was lately discovered by Gahn; and is of a greenish colour, by reason of a mixture of iron. See the article Lead, par. 6.

4. With sulphurated silver. *Galena*; also called *bleyglanz* by the Germans. Potter's ore.

a. Steel-grained.

b. With small scales.

c. Fine-grained.

d. Of a fine cubical texture; and,

e. Of coarse cubes. These two varieties are found in all the Swedish silver-mines.

f. Crystallised.

The steel-grained and scaly ores are of a dim and dull appearance when they are broken, and their particles have no determined angular figure: they are therefore in Swedish commonly called *blyschweif*; in opposition to the cubical ores, which are called *blyglanz*. The most part of the ores called *blyglanz* contain silver, even to 24 ounces *per cent.* of which we have instances in the mines of Salberg, where it has been observed, that the coarse cubical lead ores are generally the richest in silver, contrary to what is commonly taught in books; the reason of which may perhaps be, that, in making the essays on these two ores, the coarse cubical can be chosen purer or freer

freer from the rock than the fine cubical ores.

5. With fulphurated iron and filver. This is found,

a. Fine-grained. *b*. Fine cubical. *c*. Coarfe-cubical. When this ore is fcorified, it yields a black flag; whereas the preceding lead-ores yield a yellow one, becaufe they do not contain any iron.

6. With fulphurated antimony and filver; antimoniated or radiated lead-ore. This has the colour of a blyglanz, but is of a radiated texture.

It is found,

a. Of fine rays and fibres; and,

b. Of coarfe rays or fibres. The lead in this ore prevents any ufe being made of the antimony to advantage; and the antimony likewife in a great meafure hinders the extracting of the filver.

7. Mineralifed by arfenic.

This ore was lately difcovered in Siberia.—Externally it is of a pale, and internally of a deep red, colour. See the article LEAD, par. 10.

C. Mixed with earth; ftony, or fandy lead ores.

Thefe confift either of the calciform or of the galena kind, intimately mixed and diffufed through ftones and earth, chiefly of the calcareous or of the barytic genus. See LEAD, par. 11.

Ufes, &c. *of Lead*. See LEAD, and the other articles above referred to.

III. Copper; *Cuprum*, *Venus*, *Æs*. (See the article COPPER: Alfo CHEMISTRY-*Index*; and METALLURGY, Part II. fect. iv. and Part III. fect. iv.)

This metal is,

a. Of a red colour.

b. It is pretty foft and tough.

c. The calx of copper being diffolved by acids becomes green, and by alkalies blue.

d. It is eafily calcined in the fire into a blackifh blue fubftance, which, when rubbed to a fine powder, is red; when melted together with glafs, it tinges it firft reddifh brown, and afterwards of a tranfparent green or fea-green colour.

e. It diffolves in all the acids, and likewife in alkaline folutions. It is eafier diffolved when in form of a calx than in a metallic ftate, efpecially by the acids of vitriol and fea-falt, and the vegetable acid.

f. Vitriol of copper is of a deep blue colour; but the vegetable acid produces with the copper a green falt, which is verdigris.

g. It can be precipitated out of the folutions in a metallic ftate; and this is the origin of the precipitated copper of the mines called *Ziment copper*.

h. It is not eafily amalgamated with quickfilver; but requires for this purpofe a very ftrong trituration, or the admixture of the acid of nitre.

i. It becomes yellow when mixed with zinc, which has a ftrong attraction to it, and makes brafs, pinchbeck, &c.

k. When this metal is expofed to the fire, it gives a green colour to the flame in the moment it begins to melt, and continues to do fo afterwards, without lofing any thing confiderable of its weight.

[1.] Native copper.

Copper found naturally in a metallic ftate, is called *virgin* or *native copper*. It is met with,

1. Solid.

2. Friable, in form of fmall, and fomewhat coherent grains. Precipitated or ziment copper.

[2.] Calciform.

Copper, in form of a calx, is found,

1.) Pure.

A. Loofe or friable; *Ochra veneris*.

1. Blue; *Cæruleum montanum*. Very feldom found perfectly free from a calcareous fubftance.

2. Green; *Viride montanum*. Both this and the former colour depend on menftrua, which often are edulcorated or wafhed away.

3. Red. This is an efflorefcence of the glafs copper ore.

B. Indurated. Glafs copper-ore.

a. Red. This is fometimes as red as fealing wax, and fometimes of a more liver-brown colour.

It is always found along with native copper, and feems to have loft its phlogifton by way of efflorefcence, and to be changed into this form. It is likewife found with the fulphurated copper, improperly called *glafs copper-ore*.

2.) Mixed.

A. Loofe or friable; *Ochra veneris friabilis impura*.

1. Mixed with a calcareous fubftance; *Cæruleum montanum*. In this ftate copper-blue is moftly found. It ferments during the folution in aquafortis.

2. Mixed with iron. Black. It is the decompofition of the Fahlun copper ore.

B. Indurated.

1. Mixed with gypfum, or plafter. Green.

2. Mixed with quartz. *a*. Red, from Sunnerfkog in the province of Smoland

3. Mixed with lime. *a*. Blue. This is the *Lapis Armenus*, according to the accounts given of it by authors.

3.) Cupreous ftones.

Analogous to the calciform copper ores, are,

1. The *lapis armenus*. } See the detached ar-
2. The turquoife. } ticle COPPER, n° 7.

[3.] Diffolved and mineralifed; *Cuprum mineralifatum*.

A. With fulphur alone. Grey copper-ore; alfo called, improperly, *glafs copper-ore*.

a. Solid, without any certain texture, and very foft, fo that it can be cut with a knife almoft as eafily as black lead.

b. Fine cubical. In Smoland this is fometimes

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times found decomposed or weathered, and changed into a deep mountain blue.

B. With sulphurated iron. *Minera cupri pyritacea*; yellow copper ore. Marcasitical copper ore; *Pyrites cupri*. This is various both in regard to colour and in regard to the different proportion of each of the contained metals; for instance,

a. Blackish grey, inclining a little to yellow; *Pyrites cupri griseus*. When decayed or weathered, it is of a black colour; is the richest of all the varieties of this kind of copper ore, yielding between 50 and 60 *per cent.* and is found in Spain and Germany.

b. Reddish yellow, or liver brown, with a blue coat on the surface; *Minera cupri lazurea*. This ore yields between 40 and 50 *per cent.* of copper, and is commonly said to be blue, though it is as red, when fresh broken, as a red copper regulus.

c. Yellowish green; *Pyrites cupri flavo viridescens*. This is the most common in the north part of Europe: and is, in regard to its texture, found,

1. Solid, and of a shining texture.
2. Steel-grained, of a dim texture.
3. Coarse-grained, of an uneven and shining texture.
4. Crystallised marcasitical copper ore.
   a. Of long octoëdrical crystals.

d. Pale yellow. This cannot be described but as a marcasite; though an experienced eye will easily discover some difference between them. It yields 22 *per cent.* of copper.

e. Liver-coloured.

C. With sulphurated silver, arsenic, and some iron. Fallow copper-ore; which contains only a few ounces of silver. This ore is found in Hungary and Germany, where it is called *black copper ore*.

D. With sulphurated arsenic and iron. White copper ore.

E. Pyritous copper, with arsenic and zinc.

According to Mr Monnet, this ore is found at Catharineberg in Bohemia. It is of a brown colour; of a hard, solid, compact, granular texture; and contains from 18 to 30 *per cent.* of copper.

F. Dissolved by the vitriolic acid; *Vitriolum veneris*. See the article copper, n° xiii.

G. With phlogiston. Copper coal ore, consisting of the calces of copper, mixed with a bituminous earth.

H. Mineralised by the muriatic acid. This ore was found in Saxony, and had been generally mistaken for a micaceous substance, which in fact it greatly resembles. It has not yet been found in large masses, but only in a superficial form, like a crust over other ores. It is moderately hard and friable; of a fine green colour, and sometimes of a bluish green, crystallised in a cubic form, or with a foliated texture, or in little scales resembling green mica or talc. This ore is easily dissolved by nitrous acid: the solution takes a green colour; and the metal may be precipitated on a polished plate of iron. If some drops of a nitrous solution of silver be mixed with it, a white powder of *luna cornea* will be precipitated, which discovers the presence of the muriatic acid in this ore.

The uses of copper are very numerous, although not thoroughly known to every one. Several of these have been mentioned under the detached article, and in Chemistry. Others of great importance may be here added. Its great ductility, lightness, strength, and durability, render it of very extensive utility. Blocks, or bars of copper, are reduced into flat sheets of any thickness, by being first heated by the reverberation of the flame, in a low-vaulted furnace, properly constructed for the purpose; and then immediately applied between large rollers of steel, or rather of case-hardened iron, turned by a water-wheel or by the strength of horses, so that the hot metal is there quickly squeezed; and the operation is repeated, bringing the rollers every time nearer to one another, till the metallic sheet acquires the intended thickness.

These copper sheets are very advantageously employed in sheathing the bottoms of men of war and other vessels, which by this means are prevented from being attacked by the sea worms, and are kept clean from various marine concretions, so as to sail with considerably greater swiftness. Copper sheets are also employed to cover the tops of buildings instead of slates or earthen tiles, as is used in Sweden; and some architects have begun to introduce the use of copper covering into Great Britain, which is much lighter, and may be used with great advantage, although it must be much dearer in the prime cost.

Sundry preparations of copper are employed in painting, staining, and for colouring glass and enamels. See Glass and Enamel.

The solution of copper in aqua-fortis stains marble and other stones of a green colour; when precipitated with chalk or whiting, it yields the green and the blue verditer of the painters. According to Lewis, a solution of the same metal in volatile spirits stains ivory and bones: when macerated for some time in the liquor, they become of a fine blue colour, which, however, tarnishes by exposure to the air, and becomes green afterwards.

The same author prepared elegant blue glasses, by melting common glass, or powdered flint and fixed alkaline salt, with blue vitriol, and with an amalgam of copper; fine green ones were made with green verditer, and with blue verditer, as well as with the precipitate of copper made by fixed alkalies, and with a precipitate by zinc; and a reddish glass was produced by the calx and scoria of copper made by fire alone. Even in this vitreous state, it seems as if a continuance of fire had the same effect in regard to colour, as air has upon copper in other forms; as some of the most beautiful blue glasses, by continued fusion, have changed

Imperfect METALS. *Copper.*

changed to a green colour. See farther the article BRASS *in the Glass-trade.*

Verdegris is a preparation of copper dissolved by the vegetable acids, which act on this metal, dissolving it very slowly, but in considerable quantities. It produces a fine green pigment for painting both in oil and water colours, inclining more or less to the bluish according to circumstances.

So great is the tenacity of copper, that a wire of a tenth of an inch in diameter is capable of supporting 299.5 pounds weight before it breaks.—Copper may be drawn into very fine wire, and beaten into extremely thin plates. The German artists, chiefly those of Nurenberg and Ausburg, are said to possess the best method for giving to these thin plates of copper a fine yellow colour like that of gold. See the articles *BRASS-Colour* and *BRASS-Leaf.*

The parings or shreds of these very thin leaves of yellow copper being well ground on a marble plate, are reduced to a powder similar to gold, which serves to cover, by means of some gum-water, or other adhesive fluid, the surface of various mouldings or other pieces of curious workmanship, giving them the appearance of real bronze, and even of fine gold, at a very trifling expence; because the gold colour of this metallic powder may be easily raised and improved by stirring it on a wide earthen bason over a slow fire.

In some of its states, copper is as difficultly extended under the hammer as iron, but proves softer to the file, and never can be made hard enough to strike a spark with flint or other stones; from whence proceeds the use that is made of this metal for chisels, hammers, hoops, &c. in the gun-powder works.

The vitriolic acid does not act on copper unless concentrated and boiling: during this solution a great quantity of sulphureous gas flies off; afterwards a brown thickish matter is found, which contains the calx of the metal partly combined with the acid. By solution and filtration, a blue solution is obtained, which being evaporated to a certain degree, produces after cooling long rhomboidal crystals of a beautiful blue colour, called vitriol of copper; but if this solution be merely exposed a long time to the air, it affords crystals, and a green calx is precipitated, a colour which all calces of this metal assume when dried by the air. Blue vitriol, however, is seldom formed by dissolving the metal directly in the vitriolic acid. That sold in the shops is mostly obtained from copper pyrites. It may also be made by stratifying copper-plates with sulphur, and cementing them together for some time; because the vitriolic acid of the sulphur being disengaged, attacks and corrodes the metal, forming a metallic salt, which by affusion of water yields perfect crystals of blue vitriol. See VITRIOL.

Imperfect METALS, *Copper.*

The nitrous acid, on the contrary, dissolves copper when cold with great rapidity; and a great quantity of smoaking air or gas flies off, which, on being received in a pneumatic apparatus, and mixed in a glass tube with atmospheric air, shows its good or bad quality for the respiration of living animals, according as the common bulk is more or less diminished. This is one of the most important of Dr Priestley's discoveries; and various instruments known by the name of *eudiometers* have been since invented for making these experiments with ease and satisfaction. See EUDIOMETER.

But the most common use of copper is to make all sorts of large stills, boilers, pots, funnels, and other vessels employed by distillers, dyers, chemists, and various other manufacturers, who make use of large quantities of hot liquors in their various operations.

Although copper when pure is extremely valuable, on account of its ductility, lightness, and strength, it is, however, less useful on many occasions from the difficulty of forming large masses of work, as it is not an easy matter to cast copper solid, so as to retain all its properties entire. For if the heat be not sufficiently great, the metal proves deficient in toughness when cold; and if the heat be raised too high, or continued for a length of time, the copper blisters on the surface when cast in the moulds; so that the limits of its fusion are very contracted. And from these circumstances pure copper is rendered less applicable to several purposes.

We find, however, that the addition of a certain proportion of zinc removes almost all these inconveniences, and furnishes a mixed metal more fusible than copper, very ductile and tenacious when cold, which does not so readily scorify in a moderate heat, and which is less apt to rust from the action of air and moisture.

Copper is the basis of sundry compound metals for a great number of mechanical and œconomical uses of life, such as brass (Y), prince's-metal, tombac, bell-metal, white copper, &c. See CHEMISTRY, n° 1154, &c.

If the mixture is made of four to six parts of copper, with one part of zinc, it is called *Prince's-metal.* If more of the copper is taken, the mixture will be of a deeper yellow, and then goes by the name of *tombac.*

Q 2 Bell-

(Y) Brass is frequently made by cementing plates of copper with calamine, where the copper imbibes one-fourth or one-fifth its weight of the zinc which rises from the calamine. The process consists in mixing three parts of calamine and two of copper with charcoal dust in a crucible, which is exposed to a red heat for some hours, and then brought to fusion. The vapours of the calamine penetrate the heated plates of copper, and add thereby to its fusiblity, It is of great consequence for the success of this process to have the copper cut into small pieces, and intimately blended with the calamine. See CHEMISTRY, n° 1154.

In most foreign founderies the copper is broken small by mechanical means with a great deal of labour; but at

Imperfect Metals. Iron.

Bell-metal is a mixture of copper and tin, forming a compound extremely hard and sonorous, and is less subject to alterations by exposure to the air than any other cheap metal. On this account it is advantageously employed in the fabrication of various utensils and articles, as cannons, bells, statues, &c. in the composition of which, however, other metals are mixed in various proportions, according to the fancy and experience of the artist.

White-copper is prepared with arsenic and nitre, as mentioned under CHEMISTRY, n° 1157.

But the principal kind of white-copper is that with which speculums of reflecting telescopes are made. See the article SPECULUM.

VII. Iron; *Ferrum, Mars.* This metal is,

a. Of a blackish blue shining colour.

b. It becomes ductile by repeated heating between coals and hammering.

c. It is attracted by the loadstone, which is an iron ore; and the metal itself may also be rendered magnetical.

d. Its specific gravity to water is as 7,645, or 8000 : 1000.

e. It calcines easily to a black scaly calx, which, when pounded, is of a deep red colour.

f. When this calx is melted in great quantity with glass compositions, it gives a blackish brown colour to the glass; but in a small quantity a greenish colour, which at last vanishes if forced by a strong degree of heat.

g. It is dissolved by all salts, by water, and likewise by their vapours. The calx of iron is dissolved by the spirit of sea-salt and by aqua-regia.

h. The calx of the dissolved metal becomes yellow, or yellowish brown: and in a certain degree of heat it turns red.

i. The same calx, when precipitated from acids by means of the fixed alkali, is of a greenish colour; but it becomes blue when precipitated by means of an alkali united with phlogiston; in which last circumstance the phlogiston unites with the iron: these two precipitates lose their colour in the fire, and turn brown.

k. The vitriol of iron is brown.

Iron is found,

[1.] Native. See the detached article IRON.

[2.] In form of calx.

A. Pure.

A. Loose and friable. Martial ochre; *Minera ochracea.*

1. Powdery; *Ochra ferri.* This is commonly yellow or red, and is iron which has been dissolved by the vitriolic acid.

2. Concreted. Bog-ore.

a. In form of round porous balls.

b. More solid bars.

c. In small flat pieces, like cakes or pieces of money.

d. In small grains.

e. In

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at Bristol the workmen employ an easier method. A pit is dug in the ground of the manufacture about four feet deep, the sides of which are lined with wood. The bottom is made of copper or brass, and is moveable by means of a chain. The top is made also of brass with a space near the centre, perforated with small holes, which are luted with clay; through them the melted copper is poured, which runs in a number of streams into the water, and this is perpetually renewed by a fresh stream that passes through the pit. As the copper falls down it forms itself into grains, which collect at the bottom. But great precaution is required to hinder the dangerous explosions which melted copper produces when thrown into cold water; which end is obtained by pouring small quantities of the metal at once. The granulated copper is completely mixed with powdered calamine, and fused afterwards. The process lasts eight or ten hours, and even some days, according to the quality of the calamine.

It is a wonderful thing, says Cramer, that zinc itself, being simply melted with copper, robs it of all its malleability; but if it be applied in form of vapour from the calamine, the sublimates, or the flowers, it does not cause the metal to become brittle.

The method mentioned by Cramer to make brass from copper, by the volatile emanations of zinc, seems to be preferable to any other process, as the metal is then preserved from the heterogeneous parts contained in the zinc itself, or in its ore. It consists in mixing the calamine and charcoal with moistened clay, and ramming the mixture to the bottom of the melting pot, on which the copper, mixed also with charcoal, is to be placed above the rammed matter. When the proper degree of heat is applied, the metallic vapour of the zinc contained in the calamine will transpire through the clay, and attach itself to the copper, leaving the iron and the lead which were in the calamine retained in the clay, without mixing with the upper metal. Dr Watson says, that a very good metallurgist of Bristol, named John Champion, has obtained a patent for making brass by combining zinc in the vapourous form with heated copper plates; and that the brass from this manufacture is reported to be of the finest kind: but he knows not whether the method there employed is the same with that mentioned by Cramer.

Brass is sometimes made in another way, by mixing the two metals directly; but the heat requisite to melt the copper makes the zinc burn and flame out, by which the copper is defrauded of the due proportion of zinc. If the copper be melted separately, and the melted zinc poured into it, a considerable and dangerous explosion ensues; but if the zinc is only heated and plunged into the copper, it is quickly imbibed and retained. The union, however, of these two metals succeeds better if the flux composed of inflammable substances be first fused in the crucible, and the copper and zinc be poured into it. As soon as they appear thoroughly melted, they are to be well stirred, and expeditiously poured out, or else the zinc will be inflamed, and leave the red copper behind.

e. In lumps of an indeterminate figure.

All these are of a blackish brown, or a light brown colour.

B. Indurated. The blood-stone; *Hæmatites*.

(1.) Of an iron colour; *Hæmatites cærulescens*. This is of a bluish grey colour; it is not attracted by the loadstone, yields a red powder when rubbed, and is hard.

a. Solid, and of a dim appearance when broken.

b. Cubical, and of a shining appearance when broken.

c. Fibrous, is the most common *torrsten* of Sweden.

d. Scaly: the *eisenram* of the Germans.

1. Black.
2. Bluish grey. When this is found along with marcasite, it is not only attracted by the loadstone, but is of itself really a loadstone.

e. Crystallised.

1. In octoedrical crystals.
2. In polyedrical crystals.
3. In a cellular form.

These varieties are the most common in Sweden, and are very seldom blended with marcasite or any other heterogeneous substance except their diffeeent beds. It is remarkable, that when these ores are found along with marcasite, those particles which have lain nearest to the marcasite are attracted by the loadstone, although they yield a red or reddish brown powder, like those which are not attracted by the loadstone: it is likewise worth observation, that they generally contain a little sulphur, if they are imbedded in a limestone rock.

(2.) Blackish brown bloodstone; *Hæmatites nigrescens*. Kidney ore. This yields a red or brown powder when it is rubbed; it is very hard, and is attracted by the loadstone.

a. Solid, with a glassy texture.

b. Radiated.

c. Crystallised.

1. In form of cones, from Siberia.
2. In form of concentric balls, with a facetted surface. These are very common in Germany, but very scarce in Sweden.

(3.) Red bloodstone; *Hæmatites Ruber*. Red kidney ore.

a. Solid, and dim in its texture.

b. Scaly. The *eisenran* of the Germans. This is commonly found along with the iron-coloured iron glimmer, and smears the hands.

c. Crystallised, in concentric balls, with a flat or facetted surface.

(4.) Yellow bloodstone; *Hæmatites flavus*.

a. Solid.

b. Fibrous.

The varieties of the colours in the bloodstone are the same with those produced in the calces of iron made by dry or liquid menstrua and afterwards exposed to different degrees of heat.

B. Mixed with heterogeneous substances.

A. With a calcareous earth. White spathose iron ore. The *stahlstein* of the Germans.

B. With a siliceous earth. The martial jasper of Sinople.

C. With a garnet earth. Garnet and cockle or shirl.

D. With an argillaceous earth. The bole.

E. With a micaceous earth. Mica.

F. With manganese.

G. With an alkali and phlogiston. Blue martial earth. Native Prussian-like blue.

1. Loose or powdery.

H. With an unknown earth, which hardens in water. Tarras; *Cementum*.

1. Loose or granulated; *Terra Puzzolana*. This is of a reddish brown colour, is rich in iron, and is pretty fusible.
2. Indurated; *Cementum induratum*. This is of a whitish yellow colour, contains likewise a great deal of iron, and has the same quality with the former to harden soon in water when mixed with mortar. This quality cannot be owing to the iron alone, but rather to some particular modification of it occasioned by some accidental causes, because these varieties rarely happen at any other places except where volcanoes have been, or are yet, in the neighbourhood.

[3.] Dissolved or mineralised.

A. With sulphur alone.

A. Perfectly saturated; *Ferrum sulphure saturatum*. Marcasite.

B. With very little sulphur. Black iron ore. Iron stone.

This is either attracted by the loadstone, or is a loadstone itself attracting iron; it resembles iron, and yields a black powder when rubbed.

1.) Magnetic iron ore. The loadstone, *Magnes*.

a. Steel-grained, of a dim texture, from Hogberget in the parish of Gagnœf in Dalarne: it is found at that place almost to the day, and is of as great strength as any natural loadstones were ever commonly found.

b. Fine grained, from Saxony.

c. Coarse-grained, from Spetalsgrufvan at Norberg, and Kierrgrufvan, both in the province of Westmanland. This loses very soon its magnetical virtue.

d. With coarse scales, found at Sandswœr in Norway. This yields a red powder when rubbed.

2.) Refractory iron ore. This in its crude state is attracted by the loadstone.

a. Giving a black powder when rubbed; *Tritura atra*. Of this kind are,

1. Steel-grained.
2. Fine grained.

3. Course

Imperfect METALS. *Iron.*

3. Coarse grained.

This kind is found in great quantities in all the Swedish iron mines, and of this most part of the fusible ores consist, because it is commonly found in such kinds of rocks as are very fusible; and it is as seldom met with in quartz as the hæmatites is met with in limestone.

b. Rubbing into a red powder. These are real hæmatites, that are so far modified by sulphur or lime as to be attracted by the loadstone.

1. Steel-grained.
2. Fine-grained. Emery. This is imported from the Levant: it is mixed with mica, is strongly attracted by the loadstone, and smells of sulphur when put to the fire.
3. Of large shining cubes.
4. Coarse, scaly. The *eisenglimmer* or *eisenran.*

[4.] Mixed with various fossile substances.

1. With sulphur and clay; Pyrites.
2. With arsenic; called *mispickel* by the Germans, and *plate mundic* in Cornwall.
3. With sulphurated arsenic. Arsenical pyrites.
4. With vitriolic acid. Martial vitriol.
5. With phlogiston. Martial coal ore.
6. With other sulphurated and arsenicated metals. See these in their respective arrangements.

Uses and Properties of Iron. Iron is the most common metal in nature, and at the same time the most useful in common life; notwithstanding which, its qualities are perhaps very little known.

Iron has a particular and very sensible smell when strongly rubbed or heated; and a styptic taste, which it communicates to the water in which it is extinguished after ignition. Its tenacity, ductility, and malleability, are very great. It exceeds every other metal in elasticity and hardness, when properly tempered. An iron wire of one-tenth of an inch thick is able to support 450 pounds weight without breaking, as Wallerius asserts.

Iron drawn into wire as slender as the finest hairs. It is more easily malleable when ignited than when cold; whereas other metals, though ductile when cold, become quite brittle by heat.

It grows red-hot sooner than other metals: nevertheless it melts the most difficultly of all, platina and manganese excepted. It does not tinge the flame of burning matters into bluish or greenish colours, like other imperfect metals, but brightens and whitens it; hence the filings of iron are used in compositions of fire-works, to produce what is called *white-fire.*

Iron, or rather steel, expands the least of all hard metals by the action of heat; but brass expands the most: and on this account these two metals are employed in the construction of compound pendulums for the best sort of regulating clocks for astronomical purposes.

Iron, in the act of fusion, instead of continuing to expand, like the other metals, shrinks, as Dr Lewis observes; and thus becomes so much more dense as to throw up such part as is unmelted to the surface; whilst pieces of gold, silver, copper, lead, and tin, put in the respective metals in fusion, sink quickly to the bottom. But in its return to a consistent state, instead of shrinking, like other metals, it expands; sensibly rising in the vessel, and assuming a convex surface, whilst the others subside, and appear concave. This property of iron was first taken notice of by Reamur, and excellently fits it for receiving impressions from the moulds into which it is cast, being forced into their minutest cavities. Even when poured thick into the mould, it takes, nevertheless, a perfect impression; and it is observed, that cast iron is somewhat larger than the dimensions of the mould, whilst cast figures of other metals are generally smaller.

Imperfect METALS. *Iron.*

The vitriolic acid dissolves iron readily, and forms green vitriol.

This acid requires to be diluted with 304 times its quantity of water, to enable it effectually to dissolve iron; and, during the dissolution, a strong aerial fluid arises, called *inflammable air*, which, on being mixed with atmospheric air, takes fire at the approach of the flame of a candle. A glass phial, of about two ounces measure, with one third of inflammable air, and the rest of common air, produces a very loud report if opened in the same circumstance; and if it be filled with two-thirds of inflammable air, mixed with one of dephlogisticated air, the report will be as loud as the explosion of a pistol with gunpowder.

Dilute nitrous acid dissolves iron; but this saline combination is incapable of crystallising. Strong nitrous acid corrodes and dephlogisticates a considerable quantity of iron, which falls to the bottom.

Marine acid likewise dissolves iron, and this solution is also incrystallisable.

The Prussian acid precipitates iron from its solutions in the form of Prussian blue.

This metal is likewise sensibly acted upon by alkaline and neutral liquors, and corroded even by those which have no perceptible saline impregnation; the oils themselves, with which iron utensils are usually rubbed to prevent their rusting, often promote this effect in some measure, unless the oils had been previously boiled with litharge or calces of lead.

Galls, and other astringent vegetables, precipitate iron from its solutions, of a deep blue or purple colour, of so intense a shade as to appear black. It is owing to this property of iron that the common writing ink is made. The infusion of galls, and also the Prussian alkali, are tests of the presence of iron by the colours they produce on any fluid. Acids, however, dissolve the coloured precipitates by the former; and hence it arises that the marine acid is successfully applied to take off ink spots and iron stains from white linens. Alkalis, however, convert these iron precipitates into a brown ochre.

Iron has a strong affinity with sulphur. If a bar of iron be strongly ignited, and a roll of brimstone be applied to the heated end, it will combine

bine with the iron, and form a fusible mass, which will drop down. A vessel of water ought to be placed beneath for the purpose of receiving and extinguishing it, as the fumes would otherwise be very inconvenient to the operator.

A mixture of iron-filings and sulphur in powder, moistened with water, and pressed so as to form a paste, will in a few hours swell, become hot, fume, and even burst into a flame, if the quantity is large. The residuum furnishes martial vitriol. This process is similar to the decomposition of martial pyrites; from which some philosophers account for hot spring-waters and subterraneous fires. The mixture of water in this paste seems to be necessary to enable the vitriolic acid of the sulphur to act on the iron.

For other chemical properties of this metal, see CHEMISTRY-*Index*; for its electrical and magnetic properties, see ELECTRICITY and MAGNETISM. For a more particular account of its nature and uses, and the methods of making and manufacturing it, see the articles IRON and STEEL; also METALLURGY, Part II. sect. vii. and Part III. sect. v.

Order III. SEMIMETALS.

I. Bismuth; tin-glass. *Vismutum, Bismutum, Marcasita officinalis*. It is,

a. Of a whitish yellow colour.

b. Of a laminated texture, soft under the hammer, and nevertheless very brittle.

c. It is very fusible; calcines and scorifies like lead, if not rather easier; and therefore it works on the cuppel. It is pretty volatile in the fire.

d. Its glass or slag becomes yellowish brown, and has the quality of retaining some part of the gold, if that metal has been melted, calcined, and vitrified with it.

e. It may be mixed with the other metals, except cobalt and zinc, making them white and brittle.

f. It dissolves in aquafortis, without imparting to it any colour; but to the aqua-regia it gives a red colour, and may be precipitated out of both these solutions with pure water into a white powder, which is called *Spanish white*. It is also precipitated by the acid of sea-salt; which last unites with it, and makes the *vismutum corneum*.

g. It amalgamates easily with quicksilver. Other metals are so far attenuated by the bismuth, when mixed with it, as to be strained or forced along with the quicksilver through skins or leather.

Bismuth is found in the earth.

A. Native. This resembles a regulus of bismuth, but consists of smaller scales or plates.

1. Superficial, or in crusts.
2. Solid, and composed of small cubes.

B. In form of calx.

1. Powdery or friable; *Ochra vismuti*. This is of a whitish yellow colour; it is found in form of an efflorescence.

It has been customary to give the name of *flowers of bismuth* to the pale red calx of cobalt, but it is wrong; because neither the calx of bismuth, nor its solutions, become red, this being a quality belonging to the cobalt.

C. Mineralised bismuth. This is, with respect to colour and appearance, like the coarse tessellated potter's lead ore; but it consists of very thin square plates or flakes, from which it receives a radiated appearance when broken crosswise.

1. With sulphur.

a. With large plates or flakes.

b. With fine or small scales.

2. With sulphurated iron.

a. Of coarse wedge-like scales.

This mineralised bismuth ore yields a fine radiated regulus; for which reason it has been ranked among the antimonial ores by those who have not taken proper care to melt a pure regulus ore destitute of sulphur from it; while others, who make no difference between regulus and pure metals, have still more positively asserted it to be only an antimonial ore.

3. With sulphur and arsenic.

a. Of a whitish yellow or ash colour. It has a shining appearance; and is composed of small scales or plates, intermixed very small yellow flakes: It is of a hard and solid texture: Sometimes strikes fire with hard steel: Has a disagreeable smell when rubbed: Does not effervesce with aqua-fortis; but is partially dissolved by the same acid (z).

b. Grey, of a striated form; found at Helsingland in Sweden, and at Annaberg in Saxony.

c. With variegated colours of red, blue, and yellow grey; found at Schneeberg in Saxony.

d. With green fibres like an amianthus; at Misnia in Germany, and at Gillebeck in Norway.

e. With yellow red shining particles, called *mines de bismuth Tigrées* in French, at Georgenstadt in Germany, and at Annaberg in Saxony.

f. The *minera bismuthi arenacea*, mentioned by Wallerius and Bomare, belongs also to the same kind of the arsenicated ores.

4. By vitriolic acid. This ore is called *wismuth bluth* by the Germans. It is said to be of a yellowish, reddish, or variegated colour; and to be found mixed with the calx of bismuth, incrusting other ores. *Kirwan*, p. 334.

Uses, &c. *of Bismuth*. See the article BISMUTH. Also CHEMISTRY-*Index*; and METALLURGY, Part II. sect. x. and Part III. sect. viii.

II.

(z) This solution, being diluted with water, becomes a kind of sympathetic ink; as the words written with it on white paper, and dried, are not distinguished by the eye; but on being heated before the fire, they assume a yellowish colour.

SEMI-METALS. *Zinc.*

II. Zinc; fpeltre. *Zincum.*

a. Its colour comes neareft to that of lead, but it does not fo eafily tarnifh.

b. It fhows a texture when it is broken, as if it were compounded of flat pyramids (A).

c. Its fpecific gravity to water is as 6,900 or 7000 to 1000.

d. It melts in the fire before it has acquired a glowing heat; but when it has gained that degree of heat, it burns with a flame of a changeable colour, between blue and yellow. If in an open fire, the calx rifes in form of foft white flowers; but if in a covered veffel, with the addition of fome inflammable, it is diftilled in a metallic form: in which operation, however, part of it is fometimes found vitrified.

e. It unites with all the metals (B) except bifmuth and nickel, and makes them volatile. It is, however, not eafy to unite it with iron without the addition of fulphur. It has the ftrongeft attraction to gold and copper, and this laft metal acquires a yellow colour by it; which has occafioned many experiments to be made to produce new metallic compofitions.

f. It is diffolved by all the acids: of thefe the vitriolic acid has the ftrongeft attraction to it; yet it does not diffolve it, if it is not previoufly diluted with much water.

g. Quickfilver amalgamates eafier with zinc than with copper; by which means it is feparated from compofitions made with copper.

h. It feems to become electrical by friction.

Zinc is found,

A. Native.

Zinc has been met with native, though rarely, in the form of thin and flexible filaments, of a grey colour, which were eafily inflamed when applied to a fire. And Bomare affirms that he has feen many fmall pieces of native zinc among the calamine-mines in the duchy of Limbourg and in the zinc-mines at Goflar, where this femimetal was always furrounded by a kind of ferrugineous yellow earth, or ochraceous fubftances. See the detached article ZINC.

B. In form of calx.

(1.) Pure.

a. Indurated.

1. Solid

2. Cryftallifed.

This is of a whitifh-grey colour, and its external appearance is like that of a lead fpar; it cannot be defcribed, but is eafily known by an experienced eye. —It looks very like an artificial glafs of zinc; and is found among other calamines at Namur and in England.

(2.) Mixed.

A. With a martial ochre.

1. Half indurated. Calamine; *Lapis calaminaris.*

a. Whitifh yellow.

b. Reddifh brown. This feems to be a mouldered or weathered blende.

B. With a martial clay or bole.

C. With a lead ochre and iron.

D. With quartz: Zeolite of Friburgh.

The real contents of this fubftance were firft difcovered by M. Pelletier. It was long taken for a true zeolite, being of a pearl colour, cryftallifed, and femitranfparent. It confifts of laminæ, diverging from different centres, and becoming gelatinous with acids. Its contents are 48 to 52 per cent. of quartz, 36 of calx of zinc, and 8 or 12 of water. (*Kirwan*, p. 318.)

C. Mineralifed.

(1.) With fulphurated iron. Blende, mock-lead, black-jack, mock-ore; *pfeudogalena* and *blende* of the Germans

A. Mineralifed zinc in a metallic form. Zinc ore. This is of a metallic bluifh-grey colour, neither perfectly clear as a potter's ore, nor fo dark as the Swedifh iron ores.

1. Of a fine cubical or fcaly texture.

2. Steel-grained.

B. In form of calx. Blende. Mock-lead; *Sterile nigrum. Pfeudo-galena* (C). This is found,

1. With courfe fcales.

a. Yellow; femi-tranfparent.

b. Greenifh.

c. Greenifh-

(A) It cannot be reduced into powder under the hammer like other femimetals. When it is wanted very much divided, it muft be granulated, by pouring it while fufed into cold water; or filed, which is very tedious, as it ftuffs and fills the teeth of the file. But if heated the moft poffible without fufing it, Macquer afferts, that it becomes fo brittle as to be pulverifed in a mortar.

(B) It brightens the colour of iron almoft into a filver hue; changes that of copper to a yellow or gold colour, but greatly debafes the colour of gold and deftroys its malleability. It improves the colour and luftre of lead and tin, rendering them firmer, and confequently fitter for fundry mechanic ufes. Lead will bear an equal weight of zinc, without lofing too much of its malleability.—The procefs for giving the yellow colour to copper, by the mixture of zinc, and of its ore called *calamine*, has been defcribed above under the *Ufes of Copper*

(C) The varieties of pfeudo-galena, or black-jack, are in general of a lamellar or fcaly texture, and frequently of a quadrangular form, refembling galena. They all lofe much of their weight when heated, and burn with a blue flame; but their fpecific gravity is confiderably inferior to that of true galena. Almoft all contain a mixture of lead-ore. Moft of them exhale a fulphureous fmell when fcraped; or at leaft when vitriolic or marine acid is dropped on them.

c. Greenish-black; *pechblende*, or *pitch blende* of the Germans.
d. Blackish-brown.
2. With fine scales,
a. White.
b. Whitish-yellow.
c. Reddish-brown.
3. Fine and sparkling; at Goslar called *braun blyertz*. Its texture is generally scaly; sometimes crystallised and semitransparent. It gives fire with steel; but does not decrepitate, nor smoke when heated: yet it loses about 13 *per cent.* of its weight by torrefaction.
a. Dark-brown.
b. Red, which becomes phosphorescent when rubbed; found at Scharfenberg in Misnia. (*Brunich*).
c. Greenish, yellowish-green, or red. It has different degrees of transparency, and is sometimes quite opaque. When scraped with a knife in the dark, it emits light, even in water; and after undergoing a white heat, if it is distilled *per se*, a siliceous sublimate rises, which shows it contains the sparry acid, probably united to the metal, since it sublimes.
4. Of a metallic appearance; *glanz blende.*
This is of a bluish-grey, of a scaly or steel grained texture, and its form generally cubical or rhomboidal. It loses nearly one sixth of its weight by calcination; and after calcination it is more soluble in the mineral acids.
100 parts of this ore afforded to Bergman about 52 of zinc, 8 of iron, 4 of copper, 26 of sulphur, 6 of silex, and 4 of water.
5. Crystalline.
a. Dark-red, very scarce; found in a mine near Freyberg. Something like it is found at the Morgenstern and Himmelsfuste.
b. Brown. In Hungary and Transilvania.
c. Black. Hungary.
These varieties may easily be mistaken for rock crystals; but by experience they may be distinguished on account of their lamellated texture and greater softness. Their transparency arises from a very small portion of iron in them.
(2.) Zinc mineralised by the vitriolic acid.
This ore has been already described among the middle *Salts*, at *Vitriol of zinc*.
Uses, &c. *of zinc*. See the detached article Zinc: Also Chemistry-*Index*; and Metallurgy, Part II. sect. xii. and Part III. under sect. iii.

III. Antimony; *Antimonium Stibium*. This semimetal is,
a. Of a white colour almost like silver.
b. Brittle; and, in regard to its texture, it consists of shining planes of greater length than breadth.

c. In the fire it is volatile, and volatilises part of the other metals along with it, except gold and platina. It may, however, in a moderate fire, be calcined into a light-grey calx, which is pretty refractory in the fire; but melts at last to a glass of a reddish-brown colour.
d. It dissolves in spirit of sea-salt and aqua regia, but is only corroded by the spirit of nitre into a white calx; it is precipitated out of the aqua regia by water.
e. It has an emetic quality when its calx, glass, or metal, is dissolved in an acid, except when in the spirit of nitre, which has not this effect.
f. It amalgamates with quicksilver, if the regulus, when fused, is put to it; but the quicksilver ought for this purpose to be covered with warm water: it amalgamates with it likewise, if the regulus of antimony be previously melted with an addition of lime.
Antimony is found in the earth.
A. Native. *Regulus antimonii nativus.*
This is of a silver colour, and its texture is composed of pretty large shining planes.
This kind was found in Carls Ort, in the mine of Salberg, about the end of the last century; and specimens thereof have been preserved in collections under the name of an arsenical pyrites, until the mine-master Mr Von Swab discovered its real nature, in a treatise he communicated to the Royal Academy of Sciences at Stockholm in the year 1748. Among other remarkable observations in this treatise, it is said, first, That this native antimony easily amalgamated with quicksilver; doubtless, because it was imbedded in a limestone; since, according to Mr Pott's experiments, an artificial regulus of antimony may, by means of lime, be disposed to an amalgamation: Secondly, That when brought in form of a calx, it shot into crystals during the cooling.
B. Mineralised antimony.
(1.) With sulphur.
This is commonly of a radiated texture, composed of long wedge-like flakes or plates; it is nearly of a lead-colour, and rough to the touch.
a. Of coarse fibres.
b. Of small fibres.
c. Steel-grained, from Saxony and Hungary.
d. Crystallised, from Hungary.
1. Of a prismatical, or of a pointed pyramidal figure, in which last circumstance the points are concentrical.
Cronstedt mentions a specimen of this, in which the crystals were covered with very minute crystals or quartz, except at the extremities, where there was always a little hole: this specimen was given for a *flos ferri* spar.
(2.) With sulphur and arsenic. Red antimony ore; *Antimonium solare.*
This is of a red colour, and has the same texture with the preceding, though its fibres are not so course.

SEMI-METALS. *Antimony.*

a. With small fibres.

b. With abrupt broken fibres, from Braunsdorff in Saxony, and from Hungary.

All antimonial ores are somewhat arsenical, but this is more so than the preceding kinds.

(3.) With sulphurated silver. Plumose silver-ore, or *federertz* of the Germans.

(4.) With sulphurated silver, copper, and arsenic; the *dal fahl-ertz* of the Germans.

(5.) With sulphurated lead; radiated lead-ore.

(6.) By the aerial acid.

This ore was lately discovered by Mongez, among those of native antimony from the mine of Chalanges in Dauphiny. It consists of a group of white crystallised filaments of a needle-form appearance, diverging from a common centre, like zeolite. They are insoluble in nitrous acid; and, on being urged by the flame of a blow-pipe, upon a piece of charcoal, they are dissipated into white fumes, or antimonial flowers, without any smell of arsenic; from whence it follows, that these needle-formed crystals are a pure calx of antimony, formed by its combination with, or mineralised by, the aerial acid. See *Kirwan*, p. 325, and *Journal de Physique* for July 1787, p. 67.

Uses, &c. By the name of *antimony* is commonly understood the crude antimony (which is compounded of the metallic part and sulphur) as it melted out of the ore; and by the name of *regulus*, the pure semimetal.

1. Though the regulus of antimony is a metallic substance, of a considerably bright white colour, and has the splendor, opacity, and gravity of a metal, yet it is quite unmalleable, and falls into powder instead of yielding or expanding under the hammer; on which account it is classed among the semimetals.

2. Regulus of antimony is used in various metallic mixtures, as for printing types, metallic speculums, &c. and it enters into the best sort of pewter ware.

3. It mixes with, and dissolves various metals; in particular it affects iron the most powerfully; and, what is very remarkable, when mixed together, the iron is prevented from being attracted by the loadstone.

4. It affects copper next, then tin, lead, and silver; promoting their fusion, and rendering them all brittle and unmalleable: but it will neither unite with gold nor mercury; though it may be made to combine with this last by the interposition of sulphur. In this case it resembles the common Æthiops, and is thence called *antimonial Æthiops*.

5. Regulus of antimony readily unites with sulphur, and forms a compound of a very faint metallic splendor: it assumes the form of long needles adhering together laterally: it usually formed naturally also in this shape. This is called *crude antimony*.

6. But though antimony has a considerable affinity to sulphur; yet all the metals, except gold and mercury, have a greater affinity to that compound. If therefore iron, copper, lead, silver, or tin, be melted with antimony, the sulphur will unite with the metal, and be separated from the regulus, which, however, takes up some part of the metal, for which reason it is called *martial regulus*, *regulus veneris*, &c.

7. When gold is mixed, or debased by the mixture of other metals, it may be fused with antimony; for the sulphur combines with the base metals, which, being the lighter, rise up into scoria, while the regulus remains united at the bottom with the gold; which being urged by a stronger degree of heat, is freed from the semimetal, which is very volatile. This method of refining gold is the easiest of all.

8. But the most numerous purposes to which this metal has been applied are those of the chemical and pharmaceutical preparations. Lemery, in his Treatise on Antimony, describes no less than 200 processes and formulæ; among which there are many good and many useless ones. The following deserve to be mentioned on account of their utility.

9. Antimony melts as soon as it is moderately red hot, but cannot sustain a violent degree of fire, as it is thereby dissipated into smoke and white vapours, which adhere to such cold bodies as they meet with, and are collected into a kind of farina or powder, called *flowers of antimony*.

10. If it be only moderately heated, in very small pieces, so as not to melt, it becomes calcined into a greyish powder destitute of all splendor, called *calx of antimony*. This calx is capable of enduring the most violent fire; but at last it will run into a glass of a reddish-yellow colour, similar to that of the hyacinth. The infusion made of this coloured antimonial glass, in acidulous wine (such as that of Bourdeaux) for the space of 5 or 6 hours, is a very violent emetic.

11. If equal parts of nitre and regulus of antimony be deflagrated over the fire, the grey calx which remains is called *liver of antimony*.

12. If regulus of antimony be melted with two parts of fixed alkali, a mass of a reddish-yellow colour is produced, which being dissolved in water, and any acid being afterwards added, a precipitate is formed of the same colour, called *golden sulphur of antimony*.

13. Fixed nitre, viz. the alkaline salt that remains after the deflagration of nitre, being boiled with small pieces of regulus of antimony, the solution becomes reddish; and, on cooling, deposits the antimony in the form of a red powder, called *mineral kermes*.

14. Equal parts of the glass, and of the liver of antimony, well pulverised and mixed with an equal quantity of pulverised cream of tartar, being put into as much water as will dissolve the cream of tartar, and boiled for 12 hours, adding now and then some hot water to replace what is evaporated, the whole is to be filtered while hot; then being evaporated to dryness, the saline matter that remains is the emetic tartar.

15. The regulus of antimony being pulverised, and distilled

distilled with corrosive sublimate of mercury, a thick white matter is produced, which is extremely corrosive, and is called *butter of antimony*. This thick substance may be rendered limpid and fluid by repeated distillations.

16. On mixing the nitrous acid with this butter of antimony, a kind of aqua regia is distilled, called *bezoardic spirit of nitre*.

17. The white matter that remains from this last distillation may be redistilled with fresh nitrous acid; and the remainder being washed with water, is called *bezoar mineral*, which is neither so volatile nor so caustic as the antimonial butter. This butter being mixed with water, a precipitate falls to the bottom, which is very improperly called *mercurius vitæ*, for it is in fact a very violent emetic.

18. But if, instead of the regulus, crude antimony be employed, and the same operation be performed, the reguline part separates from the sulphur, unites to the mercury, and produces the substance which is called *cinnabar of antimony*.

19. Crude antimony being projected in a crucible, in which an equal quantity of nitre is fused, detonates; is calcined, and forms a compound called by the French *fondant de Retrou*, or *antimoine diaphoretique non lavé*. This being dissolved in hot water, falls to the bottom after it is cold; and after decantation is known, when dry, by the name of *diaphoretic antimony*. This preparation excites animal perspiration, and is a good sudorific. The same preparation may be more expeditiously made by one part of antimony with two and a half of nitre, mixed together and deflagrated: the residue of which is the mère calx of antimony, void of all emetic power.

20. And if the detonation be performed in a tubulated retort, having a large receiver, containing some water adapted to it, both a clyssus of antimony and the antimonial flowers may be obtained at the same time, as Neumann asserts.

21. When nitre is deflagrated with antimony over the fire, the alkaline basis of the nitre unites with the calx of the semimetal, which may be separated by an acid, and is called *materia perlata*. See farther the article Antimony; also Metallurgy, Part II. sect. ix.

IV. Arsenic. In its metallic form, is,

a. Nearly of the same colour as lead, but brittle, and changes sooner its shining colour in the air, first to yellow, and afterwards to black.

b. It appears laminated in its fractures, or where broken.

c. Is very volatile in the fire, burns with a small flame, and gives a very disagreeable smell like garlic.

d. It is, by reason of its volatility, very difficult to be reduced, unless it is mixed with other metals: However, a regulus may be got from the white arsenic, if it is quickly melted with equal parts of pot ashes and soap; but this regulus contains generally some cobalt, most of the white arsenic being produced from the cobalt ores during their calcination. The white arsenic, mixed with a phlogiston, sublimes likewise into octoedral crystals of a metallic appearance, whose specific gravity is 8,308.

e. The calx of arsenic, which always, on account of its volatility, must be got as a sublimation, is white, and easily melts to a glass, whose specific gravity is 5,000. When sulphur is blended in this calx, it becomes of a yellow, orange, or red colour; and according to the degrees of colour is called *orpiment* or yellow arsenic; *sandarach*, *realgar*, or red arsenic; and also *rubinus arsenici*.

f. This calx and glass are dissoluble in water, and in all liquids; though not in all with the same facility. In this circumstance arsenic resembles the salts; for which reason it also might be ranked in that class.

g. The regulus of arsenic dissolves in spirit of nitre; but as it is very difficult to have it perfectly free from other metals, it is yet very little examined in various menstrua.

h. It is poisonous, especially in form of a pure calx or glass: But probably it is less dangerous when mixed with sulphur, since it is proved by experience, that the men at mineral works are not so much affected by the smoke of this mixture as by the smoke of lead, and that some nations make use of the red arsenic in small doses as a medicine.

i. It unites with all metals, and is likewise much used by nature itself to dissolve, or, as we term it, to *mineralise*, the metals, to which its volatility and dissolubility in water must greatly contribute. It is likewise most generally mixed with sulphur.

k. It absorbs or expels the phlogiston, which has coloured glasses, if mixed with them in the fire.

Arsenic is found,

[1.] Native; called *Scherbencobolt* and *Fliegenstein* by the Germans.

It is of a lead colour when fresh broken, and may be cut with a knife, like black lead, but soon blackens in the air. It burns with a small flame, and goes off in smoke.

A. Solid and testaceous; *Scherbencobolt*.

B. Scaly.

C. Friable and porous; *Fliegenstein*.

(1.) With shining fissures.

This is by some called *Spigel cobolt*.

[2.] In form of a calx.

A. Pure, or free from heterogeneous substances.

1. Loose or powdery.

2. Indurated, or hardened. This is found in form of white semi-transparent crystals.

B. Mixed.

A. With sulphur.

1. Hardened.

a. Yellow. Orpiment; *Auripigmentum*.

b. Red. Native realgar, or sandarach.

B. With the calx of tin, in the tin-grains.

C. With sulphur and silver; in the *rothgulden* or red silver ore.

D. With calx of lead, in the lead-spar.

E. With calx of cobalt, in the efflorescence of cobalt.

SEMI-METALS. *Cobalt.*

[3.] Mineralised.

A. With sulphur and iron. Arsenical pyrites or marcasite. These kinds in Cornwall are called *silvery* or *white mundics* and *plate mundics*.

This alone produces red arsenic when calcined. It is of a deeper colour than the following.

B. With iron only. This differs with regard to its particles; being,

1. Steel-grained.
2. Coarse-grained.
3. Crystallised.
   a. In an octoedral figure. This is the most common kind.
   b. Prismatical. The sulphureous marcasite is added to this kind when red arsenic is to be made; but in Sweden it is scarcer than the sulphureous arsenical pyrites.

C. With cobalt, almost in all cobalt ores.

D. With silver.
E. With copper.
F. With antimony.
} See under *Silver*, *Copper*, and *Antimony*, *supra*.

For the *Uses of Arsenic*, see the detached article ARSENIC, and CHEMISTRY-*Index*; also METALLURGY, Part II. sect. xiii. and Part III. sect. viii.

V. Cobalt.

This semimetal is,

a. Of a whitish grey colour, nearly as fine-tempered steel.

b. Is hard and brittle, and of a fine-grained texture; hence it is of a dusky, or not shining appearance.

c. Its specific gravity to water is 6000 to 1000.

d. It is fixed in the fire, and becomes black by calcination: it then gives to glasses a blue colour, inclining a little to violet, which colour, of all others, is the most fixed in fire.

e. The concentrated oil of vitriol, aquafortis, and aqua-regia, dissolve it; and the solutions become red. The cobalt calx is likewise dissolved by the same menstrua, and also by the volatile alkali and the spirit of sea salt.

f. When united with the calx of arsenic in a slow (not a brisk) calcining heat, it assumes a red colour: the same colour is naturally produced by way of efflorescence, and is then called the *bloom* or *flowers of cobalt*. When cobalt and arsenic are melted together in an open fire, they produce a blue flame.

g. It does not amalgamate with quiksilver by any means hitherto known.

h. Nor does it mix with bismuth, when melted with it, without addition of some medium to promote their union.

[1.] Native cobalt. Cobalt with arsenic and iron in a metallic form.

Pure native cobalt has not yet been found: that which passes for such, according to Kirwan, is mineralised by arsenic. Bergman, however, in his Sciagraphia, has entered this present ore under the denomination of *native cobalt*: and certain it is, that among all the cobaltic ores, this is the nearest to the native state of this semimetal. It always contains a small quantity of iron, besides the arsenic, by which it is mineralised.

This is of a dim colour when broken, and not unlike steel. It is found,

a. Steel-grained, from Loos in the parish of Farila in the province of Helsingeland, and Schneeberg in Saxony.

b. Fine-grained, from Loos.

c. Coarse-grained.

d. Crystallised:
1. In a dendritical or arborescent form;
2. Polyhedral, with shining surfaces;
3. In radiated nodules.

[2.] Calciform cobalt. Cobalt is most commonly found in the earth mixed with iron.

A. In form of a calx.

1.) With iron without arsenic.

a. Loose or friable; cobalt ochre. This is black, and resembles the artificial zaffre.

b. Indurated: *Minera cobalti vitrea*. The schlacken or slag cobalt. This is likewise of a black colour, but of a glassy texture, and seems to have lost that substance which mineralised it, by being decayed or weathered.

2.) With arsenical acid; cobalt-blut, Germ. *Ochra cobalti rubra*; bloom, flowers, or efflorescence of cobalt.

a. Loose or friable. This is often found of a red colour like other earths, spread very thin on the cobalt ores; and is, when of a pale colour, erroneously called *flowers of bismuth*.

b. Indurated. This is commonly crystallised in form of deep red semitransparent rays or radiations: It is found at Schneeberg in Saxony.

B. Mineralised.

1.) With sulphurated iron.

This ore is of a light colour, nearly resembling tin or silver. It is found crystallised in a polygonal form.

a. Of a flaggy texture.

b. Coarse-grained.

This ore is found in Bastnasgrufva at Raddarshyttan in Westmanland, and discovers not the least mark of arsenic. The coarse-grained becomes slimy in the fire, and sticks to the stirring hook during the calcination in the same manner as many regules do: It is a kind of regule prepared by nature. Both these give a beautiful colour.

2.) With sulphur, arsenic, and iron. This resembles the arsenicated cobalt ore, being only rather of a whiter or lighter colour. It is found,

a. Coarse-grained.

b. Crystallised;
1. In a polygonal figure, with shining surfaces, or *glanzkobolt*. It is partly of a white or light colour, and partly of a somewhat reddish yellow.

3.) With

Semi-metals. *Nickel.*

3.) With fulphurated and arfenicated nickel and iron; fee *Kupfer-nickel*, below.

Ufes, &c. See the article Cobalt. See alfo Chemistry-*Index;* and Metallurgy, Part II. fect. xi.

VI. Nickel; *Niccolum*. This is the lateft difcovered femimetal. It was firft defcribed by its difcoverer Mr Cronftedt, in the Acts of the Royal Academy of Sciences at Stockholm for the years 1751 and 1754, where it is faid to have the following qualities:

1. It is of a white colour, which, however, inclines fomewhat to red.
2. Of a folid texture, and fhining in its fractures.
3. Its fpecific gravity to water is as 8,500 to 1000.
4. It is pretty fixed in the fire; but, together with the fulphur and arfenic, with which its ore abounds, it is fo far volatile as to rife in form of hairs and branches, if in the calcination it is left without being ftirred.
5. It calcines to a green calx.
6. The calx is not very fufible, but, however, tinges glafs of a tranfparent reddifh-brown or jacinth colour.
7. It diffolves in aquafortis, aqua-regia, and the fpirit of fea-falt; but more difficultly in the vitriolic acid, tinging all thefe folutions of a deep green colour. Its vitriol is of the fame colour; but the colcothar of this vitriol, as well as the precipitates from the folutions, become by calcination of a light green colour.
8. Thefe precipitates are diffolved by the fpirit of fal ammoniac, and the folution has a blue colour; but being evaporated, and the fediment reduced, there is no copper, but a nickel regulus is produced.
9. It has a ftrong attraction to fulphur; fo that when its calx is mixed with it, and put on a fcorifying teft under the muffel, it forms with the fulphur a regule: this regule refembles the yellow fteel-grained copper-ores, and is hard and fhining in its convex furface.
10. It unites with all the metals, except quickfilver and filver. When the nickel regulus is melted with the latter, it only adheres clofe to it, both the metals lying near one another on the fame plane; but they are eafily feparated with a hammer. Cobalt has the ftrongeft attraction to nickel, after that to iron, and then to arfenic. The two former cannot be feparated from one another but by their fcorification; which is eafily done, fince,
11. This femimetal retains its phlogifton a long time in the fire, and its calx is reduced by the help of a very fmall portion of inflammable matter: it requires, however, a red heat before it can be brought into fufion, and melts a little fooner, or almoft as foon, as copper or gold, confequently fooner than iron.

Nickel is found,

A. Native.

This is mentioned by Mr Rinman to have been lately met with in a mine of cobalt in Heffe. It is very heavy, and of a liver colour, that is, dark red. When pulverifed and roafted under a muffle, it forms green excrefcences, and fmokes; but its fmoke has no particular fmell: and no fublimate, whether fulphureous or arfenical, can be caught. It is foluble in acids, and the folution is green; but a polifhed iron plate difcovers no copper.

Semi-metals. *Manganefe.*

B. In form of a calx. Nickel ochre, aerated nickel.

1. Mixed with the calx of iron. This is green, and is found in form of flowers on kupfernickel.

C. Mineralifed.

1. With fulphurated and arfenicated iron and cobalt; *Kupfernickel*. This is of a reddifh yellow colour; and is found,
   a. Of a flaggy texture.
   b. Fine-grained; and
   c. Scaly. Thefe two are often from their colour confounded with the liver-coloured marcafite.
2. With the acid of vitriol. This is of a beautiful green colour, and may be extracted out of the nickel ochre, or efflorefcence of the Kupfernickel.

For a full account of this femimetal, fee the article Nickel, and Chemistry-*Index*.

VII. Manganefe. *Manganefium*.

The ores of this kind are in Swedifh called *brunften;* in Latin *fydereæ*, or *magnefiæ nigræ*, in order to diftinguifh them from the *magnefia alba officinalis;* and in French *manganefe*, &c.

1. Manganefe confifts of a fubftance which gives a colour both to glaffes and to the folutions of falts, or, which is the fame thing, both to dry and to liquid menftrua, viz.
   a. Borax, which has diffolved manganefe in the fire, becomes tranfparent, of a reddifh brown or hyacinth colour.
   b. The microcofmic falt becomes tranfparent with it, of a crimfon colour, and moulders in the air.
   c. With the fixed alkali, in compofitions of glafs, it becomes violet; but if a great quantity of manganefe is added, the glafs is in thick lumps, and looks black.
   d. When fcorified with lead, the glafs obtains a reddifh brown colour.
   e. The lixivium of deflagrated manganefe is of a deep red colour.
2. It deflagrates with nitre, which is a proof that it contains fome phlogifton.
3. When reckoned to be light, it weighs as much as an iron ore of the fame texture.
4. When melted together with vitreous compofitions, it ferments during the folution: but it ferments in a ftill greater degree when it is melted with the microcofmic falt.
5. It does not excite any effervefcence with the nitrous acid: aqua-regia, however, extracts the colour out of the black manganefe, and diffolves likewife a great portion of it, which by means of an alkali is precipitated to a white powder.

6. Such

SEMI-METALS. *Molybdena.*

6. Such colours as are communicated to glasses by manganese, are easily destroyed by the calx of arsenic or tin: they also vanish of themselves in the fire.

7. It is commonly of a loose texture, so as to colour the fingers like soot, though it is of a metallic appearance when broken.

Manganese is found,

[1.] Native; of the discovery and qualities of which, an account is given under the article MANGANESE in its alphabetical order. See also CHEMISTRY-*Index*.

[2.] Calciform.

A. Loose and friable.

a. Black; which seems to be weathered or decayed particles of the indurated kind.

B. Indurated.

1.) Pure, in form of balls, whose texture consists of concentric fibres. *Pura sphærica radiis concentratis.*

a. White; very scarce.

2.) Mixed with a small quantity of iron.

a. Black manganese, with a metallic brightness. This is the most common kind, and is employed at the glass-houses and by the potters. It is found,

1. Solid, of a flaggy texture.
2. Steel-grained.
3. Radiated.
4. Crystallised, in form of coherent hemispheres.

VIII. Molybdena.

A. Lamellar and shining, its colour similar to that of the potter's lead-ore.

This substance resembles plumbago or black-lead; and has long been confounded with it, even by Cronstedt. But it possesses very different properties; in particular,

1. Its laminæ are larger, brighter: and, when thin, slightly flexible. They are of an hexagonal figure.
2. It is of a lead colour, and does not strike fire with hard steel.
3. Its specific gravity is = 4,569, according to Kirwan; and 4,7385, according to Brisson.
4. When rubbed on white papper, it leaves traces of a dark brown or bluish colour, as the plumbago or black lead does; but they are rather of an argentine gloss; by which circumstance the molybdena, according to Dr d'Arcet, may be easily distinguished from black-lead, as the traces made by this last are of less brilliant, and of a deeper tinge.
5. In an open fire, it is almost entirely volatile and infusible. Microcosmic salt or borax scarcely affect it; but it is acted upon with much effervescence by mineral alkali, and forms with it a reddish mass, which smells of sulphur.
6. It consists of an acid of peculiar nature (see CHEMISTRY-*Index*.) united to sulphur. A small proportion of iron is commonly found in it, but this seems merely fortuitous: 100 parts of molybdena contain about 45 of this acid and 55 of sulphur.
7. It is decomposed either by detonation with nitre, or by solution in nitrous acid.
8. This acid is soluble in 570 times its weight of water in the temperature of 60; the solution reddens that of litmus, precipitates sulphur from the solution of liver of sulphur, &c. The specific gravity of the dry acid is 3,460.
9. This acid is precipitable from its solution in water by the Prussian alkali, and also by tincture of galls: the precipitate is reddish brown.
10. If this acid be distilled with three times its weight of sulphur, it reproduces molybdena.
11. The solution of this acid in water unites to fixed alkalies, and forms crystallisable salts; as it also does with calcareous earth, magnesia, and argil: these last combinations are difficultly soluble. It acts also on the base metals, and with them assumes a bluish colour.
12. This solution procipitates silver, mercury, or lead, from the nitrous acid, and lead from the marine, but not mercury.
13. It also precipitates barytes from the nitrous and marine acids, but no other earth. Molybdenous baroselenite is soluble in cold water.
14. This acid is itself soluble in the vitriolic acid by the assistance of heat; and the solution is blue when cold, though colourless while hot; it is also soluble in the marine acid, but not in the nitrous.
15. Molybdena tartar and ammoniac precipitate all metals from their solutions by a double affinity. Gold, sublimate corrosive, zinc, and manganese, are precipitated white; iron or tin, from the marine acid, brown; cobalt, red; copper, blue; alum and calcareous earth, white.
16. This acid has been lately reduced by Mr Hielm; but the properties of the regulus thus obtained are not yet published.
17. Mr Pelletier obtained also the regulus or molybdena, by mixing its powder with oil into a paste, and exposing it with powdered charcoal in a crucible to a very violent fire for two hours. See CHEMISTRY-*Index*, n° 14, 97.
18. This semimetal being urged by a strong fire for an hour, produces a kind of silvery flowers, like those of antimony.
19. Molybdena is said to be soluble in melted sulphur; which seems highly probable, as sulphur is one of its component parts.

See farther the article MOLYBDENA, and CHEMISTRY-*Index*.

SEMI-METALS. *Wolfram.*

IX. Wolfram. *Wolfranum*, *Spuma Lupi*, Lat. See the detached article WOLFRAM.

This mineral has the appearance of manganese, blended with a small quantity of iron and tin.

1. With coarse fibres.

a. Of an iron-colour, from Altenberg in Saxony. This gives to the glass compositions, and also to borax and the microcosmic salt, an opaque whitish yellow colour, which at last vanishes.

X. Siderite. } See those words in the order of the
XI. Saturnite. } alphabet.

Appendix.
SAXA.

APPENDIX.

Of Saxa and Petrifactions.

THOUGH the *Saxa*, and fossils commonly called *Petrifactions*, cannot, in strictness, be ranked in a mineral system, for the reasons formerly given; yet as these bodies, especially the latter, occupy so considerable a place in most mineral collections, and the former must necessarily be taken notice of by the miners in the observations they make in subterranean geography, it appeared proper to subjoin them in such an order as might answer the purpose for which they are regarded by miners and mineralogists.

Order I. SAXA. *Petræ.*

These may be divided into two kinds.

1. Compound saxa, are stones whose particles, consisting of different substances, are so exactly fitted and joined together, that no empty space, or even cement, can be perceived between them; which seems to indicate, that some, if not all, of these substances have been soft at the instant of their union.

2. Conglutinated stones, are stones whose particles have been united by some cementitious substance, which, however, is seldom perceivable, and which often has not been sufficient to fill every space between the particles: in this case the particles seem to have been hard, worn off, and in loose, single, unfigured pieces, before they were united.

I. Compound saxa.

A. Ophites. Scaly limestone with kernels or bits of serpentine stone in it.

1. *Kolmord marble.* It is white and green.
2. *Serpentino antico*, is white, with round pieces of black steatites in it. This must not be confounded with the *serpentino verde antico.*
3. The *Haraldsio marble.* White, with quadrangular pieces of a black steatites.
4. The *marmor pozzevera di Genova.* Dark green marble, with white veins. This kind receives its fine polish and appearance from the serpentine stone.

B. Stellsten or *gestelstein.* Granitello.

1. Of distinct particles. In some of these the quartzose particles predominate, and in others the micaceous: in the last case it is commonly slaty, and easy to split.
2. Of particles which are wrapt up in one another.
   a. Whitish grey.
   b. Greenish.
   c. Reddish.

C. Norrka. Murksten of the Swedes. *Saxum compositum mica, quartzo, et granato.*

1. With distinct garnets or shirl.
   a. Light grey.
   b. Dark grey.
   c. Dark grey, with prismatical, radiated, or fibrous cockle or shirl.
2. With kernels of garnet-stone.
   a. Of pale red garnet stone.

The first of this kind, whose slaty strata makes it commonly easy to be split, is employed for mill-stones, which may without difficulty be accomplished, if sand is first ground with them; because the sand wearing away the micaceous particles on the surfaces, and leaving the garnets predominent, renders the stone fitter for grinding the corn.

D. The whetstone, *Cos. Saxum compositum mica, quartzo, et forsan argilla martiali in nonnullis speciebus.*

1. Of coarse particles.
   a. White.
   b. Light grey.
2. Of fine particles.
   a. Liver-brown colour.
   b. Blackish grey.
   c. Light grey.
   d. Black. The table-slate, or that kind used for large tables and for school slates.
3. Of very minute and closely combined particles. The Turkey-stone *. This is of an olive colour, and seems to be the finest mixture of the first species of this genus. The best of this sort come from the Levant, and are pretty dear. The whetstone kinds, when they split easily and in thin plates, are very fit to cover houses with, though most of them are without those properties.

* See V. (p. 86. col. 1.)

F. Porphyry; *Porphyrites.* Italorum *porfido. Saxum compositum jaspide et feltspato, interdum mica et basalte* (D). See the article PORPHYRY.

a. Its colour is green, with light-green feltspat, *Serpentino verde antico.* It is said to have been brought from Egypt to Rome, from which latter place the specimens of it now come.
b. Deep red, with white feltspat.
c. Black, with white and red feltspat.
d. Reddish brown, with light red and white feltspat.
e. Dark grey, with white grains of feltspat also. The dark red porphyry has been most employed for ornaments in building; yet it is not the only one known by the name

(D) Great part of the hill of Bineves in Lochaber is composed of a kind of porphyry. It is remarkably fine, beautiful, and of an elegant reddish colour; "in which (says Mr Williams) the pale rose, the blush, and the yellowish white colours, are finely blended and shaded through the body of the stone; which is of a jelly-like texture, and is undoubtedly one of the finest and most elegant stones in the world. On this hill also is found a kind of porphyry of a greenish colour, with a tinge of brownish red. It is smooth, compact, and heavy; of a close uniform texture, but has no brightness when broken. It has angular specks in it of a white quartzy substance."

name of *porfido*, the Italians applying the same name also to the black kind.

G. The *trapp* of the Swedes. *Saxum compositum jaspide martiali molli, seu argilla martiali indurata.* See the article TRAPP.

This kind of stone sometimes constitutes or forms whole mountains; as, for example, the mountain called *Hunneberg* in the province of Westergotland, and at Drammen in Norway; but it is oftener found in form of veins in mountains of another kind, running commonly in a serpentine manner, contrary or across to the direction of the rock itself. It is not homogeneous, as may be plainly seen at those places where it is not pressed close together; but where it is pressed close, it seems to be perfectly free from heterogeneous substances.—When this kind is very coarse, it is interspersed with feltspat; but it is not known if the finer sorts likewise contain any of it. Besides this, there are also some fibrous particles in it, and something that resembles a calcareous spar; this, however, does not ferment with acids, but melts as easy as the stone itself, which becomes a black solid glass in the fire. By calcination it becomes red, and yields in assays 12 or more *per cent.* of iron. No other sort of ore is to be found in it, unless now and then somewhat merely superficial lies in its fissures; for this stone is commonly, even to a great depth in the rock, cracked in acute angles, or in form of large rhomboidal dice. It is employed at the glass houses, and added to the composition of which bottles are made. In the air it decays a little, leaving a powder of a brown colour; it cracks commonly in the fire, and becomes reddish brown if made red-hot. It is found,

1. Of coarse chaffy particles.
   a. Dark grey.
   b. Black.
2. Coarse-grained.
   a. Dark grey.
   b. Reddish.
   c. Deep brown.
3. Of fine imperceptible particles.
   a. Black. The touchstone; *Lapis lydius.*
   b. Bluish.
   c. Grey.
   d. Reddish.

The black variety (3. *a.*) is sometimes found so compact and hard, as to take a polish like the black agate: it melts, however, in the fire to a black glass; and is, when calcined, attracted by the load-stone.

H. *Amygdaloides.* The carpolithi or fruit-stone rocks of the Germans.

It is a martial jasper, in which elliptical kernels of calcareous spar and serpentine stone are included.

a. Red, with kernels of white limestone, and of a green steatites. This is of a particular appearance, and when calcined is attracted by the loadstone; it decays pretty much in the air, and has some affinity with the trapp, and also with the porphyry. There are sometimes found pieces of native copper in this stone.

I. The *gronsten* of the Swedes.

Its basis is horneblende, interspersed with mica. It is of a dark green colour, and in Smoland is employed in the iron furnaces as a flux to the bog-ore.

K. The granite. *Saxum compositum feltspata, mica et quartzo, quibus accidentaliter interdum horneblende steatites, granatus et basaltes immixti sunt.* Its principal constituent parts are felt-spat, or rhombic quartz, mica, and quartz. See the article GRANITE.

It is found,

(1.) Loose or friable. This is used at the Swedish brass-works to cast the brass in, and comes from France.

(2.) Hard and compact.
   a. Red.
      1. Fine-grained;
      2. Coarse-grained.
   b. Grey, with many and various colours (E).

II. Con-

(E) Mr Wiegleb has analysed a species of green granite found in Saxony. The crystals are heaped together, and form very compact layers; the colour sometimes an olive green, sometimes resembling a pear, and sometimes of a reddish brown; some of them being perfectly transparent, and others nearly so. According to Mr Warren, they contain 25 per cent. of iron; whence they have been called green ore of iron. An ounce of these crystals heated red hot in a crucible lost two grains in weight, and became of the colour of honey. The remainder was put into a retort, and distilled with marine acid, with which it evidently effervesced. The residuum was lixiviated with distilled water, fresh muriatic acid added, and the distillation and lixiviation repeated. The iron precipitated from this lixivium, and reduced partly to its metallic state, weighed two drachms. M. Wiegleb concludes, that the specimen contained two drams 26½ grains of lime. From further experiments he concludes, that 100 parts of the substance contained 36.5 of siliceous earth; lime 30.8; iron 28.7; and water and fixed air 4.0.

Scotland is remarkable for a great number of excellent granites, little or nothing inferior to porphyry. Of these the following kinds are mentioned by Mr Williams.

1. The grey granite, or *moor-stone* as it is called in Cornwall, is very common in this country. In some places it shows no marks of strata; and in others it is disposed in thick unwieldy irregular beds, which are commonly broken transversely into huge masses or blocks of various sizes and shapes. There is a great variety in this kind of stones; some of them differing but little in appearance from basaltes; others are composed of almost equal parts of black and white grains, about the size of small pease, whence it is called *peasy whin* by the

II. Conglutinated faxa.

A. Of larger or broken pieces of ftones of the fame kinds conglutinated together. *Breccia.*

1. Of limeftone cemented by lime.

a. Calcareous breccia; the *marmi brecciati* of the Italians.

When thefe kinds have fine colours, they are polifhed and employed for ornaments in architecture and other œconomical ufes.

b. The *lumachella* of the Italians, or fhell marbles. Thefe are a compound of fhells and corals, which are petrified or changed into lime, and conglutinated with a calcareous fubftance. When they have many colours, they

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the common people. In Galloway and other places it frequently has a longitudinal grain, as if the component parts had been all moved one way by a gentle flow of water. When this kind of granite begins to undergo a fpontaneous decompofition by expofure to the atmofphere, we obferve that it is compofed of pretty large grains of the figures of cubes, rhomboids, &c. fome of them fo large as to deferve the name of fragments; and the largeft of thefe are always of quartz or feldfpath, and talc.

2. Reddifh granite, of a gellied texture, which, Mr Williams fays, is one of the fineft and moft elegant ftones in the world. The mountains of Bineves, he fays, are principally compofed of this ftone; and it is found in great abundance in many other parts of Scotland, but he never faw it exhibit any marks of ftratification.

3. The fine reddifh granites, in which feveral fine fhades of colours are blended together, not fpread out in tints as in the former. Neither this nor the former are ftratified: "On the contrary (fays our author), both exhibit fuch a degree of uniform regularity, that in fome places there is no difference between a ftone and a mountain, excepting only in magnitude; as many mountains of granite are nothing more than one regularly uniform mafs throughout, in which not the leaft mark of a bed is to be feen, nor hardly a crack or fiffure, unlefs it be at the edge of fome precipice or declivity. Thefe two varieties of elegant red granite are met with in the Highlands and Lowlands of Scotland, in Galloway, and many other places. We often find maffes of talc fo large in this fecond variety, that fome of them may be called fragments, not difpofed in any order, but higgledy-piggledy through the body of the ftone.

4. Stratified reddifh granite, refembling the third in colour and quality, but not always quite fo pure or free from admixture of other ftony matter of a different quality. This variety frequently contains larger and fmaller fragments of fine laminated talc. Mr Williams, however, has feen this kind of granite difpofed in pretty regular ftrata in the fhires of Moray and Nairn, and other parts of Scotland.

5. Granite of a white and whitifh colour, generally of a granulated texture, containing a great quantity of mica, or fmall-leaved talc, and the grains of quartz fometimes large and angular. This variety is fubject to fpontaneous decompofition; part frequently diffolves and falls into lakes, in fuch an exceedingly fine and attenuated ftate, that it does not fink in the water. "I have found (fays Mr Williams) this fubftance in many places where water had been accidentally drained off, refembling fine fhell marle, only much lighter. When thoroughly dry, it is the lighteft foffile fubftance I ever handled; and, when blanched with rain, it is as white as fnow. This variety of granite is either not ftratified, or exhibits thick irregular beds. It frequently contains a confiderable quantity of talc, in maffes and fcales too large to be called mica."

Our author is of opinion, that this fine white fubftance produced from the decompofition of the granite, is the true kaolin of the Chinefe, one of the component parts of porcelain ware. "The authors of the Hiftory of China (fays he) informs us, that the fine porcelain ware is compofed of two different foffile fubftances, called by them *petuntfe* and *kaolin*. We are further told, that the petuntfe is a fine white vitrefcible ftone, compact and ponderous, and of confiderable brightnefs in the infide when broken, which they grind to a fine powder; and that the kaolin is not a ftone, but a fine white earthy fubftance, not vitrifiable, at leaft not in the heat of a common potter's furnace: that they mix the kaolin and the flour of the petuntfe together, and form a pafte of this mixture, which they mould into all forts of porcelain veffels. Now, from the beft accounts of this matter which I have been able to obtain, after a good deal of fearch and inquiry, it appears to me, that the fediment which I have mentioned above is the true kaolin; and that as the fine white glaffy quartz, which is found in irregular maffes, and in irregular difcontinuous veins or ribs, in fome of the rocks of fchiftus, is the true petuntfe; and if this obfervation is really true, it deferves to be remarked, that Scotland is as well furnifhed with the beft materials for making fine porcelain as moft countries in the world. The fpecies of quartz which I fuppofe to be petuntfe is of a pure fine uniform glaffy texture, femitranfparent, and of a pure fnowy whitenefs. A broken piece of this ftone, and a newly broken piece of fine porcelain, are very like one another. There is a great quantity of petuntfe, or pure white quartz, in many places of Scotland, particularly in the north and Highlands. There is a confiderable quantity of it upon the fhore and wafhed by the tide between Banff and Cullen, generally in pretty large maffes in rocks of bluifh fchiftus; and to the beft of my memory it is very fine of the kind. There is alfo a confiderable quantity of it in difcontinuous ribs and maffes, in rocks of blue fchift, about three or four miles north of Callendar in Monteith, upon the fide of the high road which runs parallel to Lochleodunich, which I think alfo very fine. In fome places this fort of quartz is tinged with a flefh colour from the neighbourhood of iron, which renders it unfit for porcelain; but there is plenty to be found of a pure white in almoft all parts of Scotland, without any mineral tinge whatever. The kaolin is perhaps as plentiful in Scotland as the petuntfe, there being many extenfive lakes eafily drained, which contain a confiderable depth of it; and moreover, it is to be found in many places that have been lakes, which are now laid dry by accident. There is a quantity of kaolin about

they are called *marbles*, and employed for the same purposes as the preceding (F).

2. Of kernels of jasper cemented by a jaspery substance. *Breccia jaspidea*. *Diaspro brecciato* of the Italians.

Of this kind specimens from Italy are seen in collections. A coarse jasper breccia is said to be found not far from Frejus in Provence in France.

3. Of siliceous pebbles, cemented by a jaspery substance,

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100 yards below the high road upon the south side of a bridge, about a mile and a half or two miles south of the inn of Aviemore in the Highlands. It lies beneath a stratum of peat bog, in a place which has been a lake, but is now drained by the river Spey cutting through one side of the mound which formed the lake.—There is more than one stratum of the kaolin in this place, and some of it is exceeding white, especially when blanched by the rain; and there is a white granite rock up the rivulet, at some distance above the bridge, the decomposition and dissolution of which is supposed to produce this fine and curious sediment. Several lakes in the Highlands of Scotland are nearly full of kaolin. One of them is situated in the country of Stratherig in Invernefs-shire, less than a mile north of the public road, and upon the west side of the farm of Drimin. It is a pretty long lake, and there is a considerable depth of kaolin in it, which may be drained at a moderate expence; and, if I remember well, the granite rocks which surround it are pretty white and fine. If the kaolin originates from coloured granite, it is good for nothing, especially if it contains the least tinge of iron, because this will discolour and spoil the beauty of the porcelain; but wherever white granite is found composed of quartz, feldspath, and mica, without any admixture of shirl, and especially iron, the kaolin should be diligently sought after in that neighbourhood. Lochdoon, in Galloway, is said to contain a great quantity of kaolin. It was drained some years ago on the supposition of its containing shell marle; but on trying the substance contained in it, it was found not to be marle but kaolin. These substances may easily be mistaken for one another at first; but they are easily distinguished by trying them with acids, the marle readily effervescing with the weakest, and the kaolin not at all with the strongest acid liquors."

6. Grey composite granite is a very beautiful stone, and when broken looks as if composed of small fragments of various sizes and shapes, not unlike calve's-head jelly. When polished, the fragments appear as if set or inlaid in a fine pellucid or water-coloured matter. There is a single stratum of very curious composite granite, a little to the west of Lossiemouth, in the county of Moray, in Scotland of about six or eight feet thick. It is composed chiefly of grains and fragments of various bright and elegant colours, most of which are as large as pease and beans, all fine, hard, and semipellucid; there is about an eighth part of good lead ore in the composition of this stone, of the kind commonly called potter's ore; and it is likewise remarkable, that there is no other granite in that neighbourhood but this single stratum, all the strata above and below it being mostly a coarse, imperfect, grey sand-stone.

7. Granite of a loose friable texture, subject to spontaneous decomposition, and reduction to granite gravel. There is a remarkable rock of this kind near the Queen's-ferry in Scotland, on the road to Edinburgh, which appears in prodigious thick irregular strata. This rock seems to be composed chiefly of quartz, shirl, and some iron; and produces excellent materials for the high roads.

8. In many parts of the north of Scotland, in the Highlands, and in Galloway, there is found an excellent species of grey granite, composed chiefly of red and black coloured grains. This is a fine and very durable stone, very fit for all kinds of architecture.

In speaking of these stones, Mr Williams observes, that the finer and most elegant red granites, and the finest granite-like porphyries, so much resemble one another, that he does not attempt to distinguish them; and Scotland is remarkable for a great number and variety of them. "The elegant reddish granite of Bineves, near Fort William (says he), is perhaps the best and most beautiful in the world; and there is enough of it to serve all the kingdoms on earth, though they were all as fond of granite as ancient Egypt. There are extensive rocks of red granite upon the sea-shore to the west of the ferry of Ballachylish in Appin, and likewise at Strontian, as well as many other parts of Argyleshire. I have seen beautiful red granite by the road side, near Dingwall, and in several other parts of the north of Scotland, which had been blown to pieces with gunpowder, and turned off the fields. There are extensive rocks of reddish granite about Peterhead and Slains, and both of red and grey granite in the neighbourhood of Aberdeen. The hill of Cruffel in Galloway, and several lower hills and extensive rocks in that neighbourhood, are of red and grey granite, where there are great varieties of that stone, and many of them excellent. Upon the sea shore near Kinnedore, west of Lossiemouth, in Moray, there is a bed of stone about eight feet thick, which I think should be called a composite granite. It is composed of large grains, or rather small pieces of bright and beautiful stones of many different colours; and all the stony parts are exceedingly hard, and fit to receive the highest polish. About a sixth or eighth part of it also consists of lead ore, of that species called potter's ore. The separate stony parts composing this stratum are all hard, fine, solid, and capable of the most brilliant polish; and if solid blocks can be raised free from all cracks and blemishes, I imagine, from the beauty and variety of colours of the stony part, and the quantity of bright lead ore which is blended through the composition and body of the stone, that this would be a very curious and beautiful stone when polished."

(F) The stones called *Ludi Helmontii* or *Paracelsi*, have some similarity in their form to the *brecciæ*, *a. b.*: for they are composed of various lumps of a marly whitish-brown matter, separated into a great number of polygonous compartments, of various sizes, formed of a whitish-yellow crust of a red calcareous spar, sometimes

ſubſtance, or ſomething like it. The plum-pudding ſtone of the Engliſh; *Breccia ſilicea.* Its baſis, which at the ſame time is the cement, is yellow; wherein are contained ſingle flinty or agaty pebbles, of a grey colour or variegated. This is of a very elegant appearance when cut and poliſhed: it is found in England and Scotland (G).

4. Of quartzoſe kernels combined with an unknown cement. *Breccia quartzoſa.*
5. Of kernels of ſeveral different kinds of ſtones. *Breccia ſaxoſa.*

   a. Of kernels of porphyry, cemented by a porphyry or coarſe jaſpery ſubſtance; *Breccia porphyrea.*
   b. Of kernels of ſeveral ſaxa; *Breccia indeterminata.*
   c. Of conglutinated kernels of ſandſtone; *Breccia arenacea.* This kind conſiſts of ſandſtone kernels, which have been combined a ſecond time together.

The above mentioned brecciæ of themſelves muſt demand the diſtinctions here made between, but which perhaps may ſeem to be carried too far,

times pyritous, which often riſe a little above the external ſurface, and incloſe each of them on the inſide. According to Bomare, the *ludus ſtellatus helmontii*, found in the county of Kent, is covered with a kind of ſtriated ſelenite reſembling the zeolite. They are for the moſt part of a globoſe figure, ſeldom flat, but often convex on the outſide; and ſometimes with a concave ſurface.

According to Wallerius, the *ludus helmontii* loſes by calcination about half of its weight; and, on being urged by fire, is melted into a black glaſſy ſlag. It effervesces ſtrongly with aqua-fortis, and this ſolution is of a yellow colour. But what ſeems very extraordinary, by adding to it ſome oil of tartar *per deliquium*, bubbles are produced, from which a great number of ſlender black threads or filaments are produced, ſticking like a cobweb to the ſides and bottom of the veſſel.

Theſe ſtones are found quite ſeparate by themſelves, as well as various ſtalagmites and cruſtaceous bodies, on the ſtrata of argillaceous earth, in various parts of Europe, chiefly in Lorrain, Italy, England (in the counties of Middleſex and Kent), and elſewhere.

Wallerius ranges the *ludus helmontii* among the *tophi*, in the Spec. 425. of his Syſtem of Mineralogy. Paracelſus had attributed to theſe ſtones a lithontriptic power, and Dr Grew ſays that they are diuretic; but there is not the leaſt proof of their really poſſeſſing ſuch qualities.

(G) The breccia ſtratum, or plumpudding-rock, exhibits a ſingular appearance as it lies in the ground; being compoſed of water-rounded ſtones of all qualities and of all ſizes, from ſmall gravel up to large rounded ſtones of ſeveral hundreds weight each; the interſtices being filled up with lime and ſand. It frequently alſo contains lime and iron. Sometimes it exhibits a groteſque and formidable appearance; containing many large bullets of various ſizes and ſhapes, without any marks of regular ſtratification, but looking like one vaſt maſs of bullets of unequal thickneſs; and in this manner frequently ſwelled to the ſize of a conſiderable mountain. It is frequently cemented very ſtrongly together; ſo that parts of the hills compoſed of it will frequently overhang in dreadful precipices, leſs apt to break off than other rocks in the ſame ſituation; one reaſon for which, beſides the ſtrength of the cement, is, that the breccia, when compoſed of bullets, is leſs ſubject to fiſſures and cutters than other rocks; being frequently found in one ſolid maſs of great extent and thickneſs. Some of the plumpudding-rocks are made up of ſmaller parts, coming near to the ſize of coarſe gravel. It is evident, however, that all the parts of the breccia, whether courſe or fine, have been rounded by agitation in water, as the rocks differ nothing in appearance from the coarſer and finer gravel found upon the beach of the ſea, excepting only that the parts are ſtrongly cemented together in the rocks, and are looſe upon the ſhores of the ocean.

Some of the breccia is compoſed of finely rounded ſtones of various and beautiful colours, about the ſize of plums or nuts, all very hard and fine. Were this ſpecies ſawed and poliſhed, it would appear as beautiful and elegant as any ſtone in Europe; much reſembling moſaic werk in ſmall patterns.

In general, the breccia is regularly ſtratified or not according to the ſize of the component parts of the ſtone. Such rocks as are compoſed of round gravel and ſmall bullets are generally very regular in their ſtratification, while thoſe which contain bullets ſomewhat larger in ſize are commonly diſpoſed in thick and coarſe beds, and ſuch rocks as are made up of the largeſt kind of bullets ſeldom ſhow any marks of ſtratification at all.

Among many other places in Scotland, where breccia or pudding-ſtone abounds, there are extenſive rocks and high cliffs of it upon the ſouth ſhore at the weſt end of the Pentland Frith, to the weſtward of Thurſo in Caithneſs, which ſtretch quite acroſs the county of Caithneſs into Sutherland; and in Sutherland as well as Caithneſs, this rock is of a rough contexture, and appears in pretty high hills, deep glens, overhanging rocks, and frightful precipices, to the weſt of Brora, Dunrobin, and Dornoch, which gives it a groteſque and formidable appearance in that country. This range of breccia ſtretches alſo quite through Sutherland, and likewiſe through Roſsſhire, the weſt ſide of Ferndonald, and Dingwall, where it exhibits the very ſame phenomena as in Sutherland and Caithneſs. It continues the ſame longitudinal line of bearing, which is nearly from north-eaſt to ſouth-weſt, quite through the highland countries of Inverneſs and Perthſhire; and it forms conſiderable hills, and very high and rugged rocks, upon both ſides of that beautiful piece of freſh water Loch-neſs. Much of the ſtone here, as well as in other places in this range, is compoſed of large bullets; the rock is very hard and ſtrong, and it hangs in frightful precipices upon both ſides of the lake, through which rock General

far, since their particles are so big and plain as to be easily known from one another. These stones are a proof both of the subversions which the mountains in many centuries have undergone, and of some hidden means which nature makes use of in thus cementing different kinds of stones together. Any certain bigness for the kernels or lumps in such compounds, before they deserve the name of *breccia*, cannot be determined, because that depends on a comparison which every one is at liberty to imagine. In some places, the kernels of porphyry have a diameter of six feet, while in others they are no bigger than walnuts. Sometimes they have a progressive size down to that of a fine sandstone. Most of this kind of stone is fit for ornaments, though the workmanship is very difficult and costly.

B. Conglutinated stones of granules or sands of different kinds. Sandstone; *Lapis arenaceus*.

In this division are reckoned those which consist of such minute particles, that all of them cannot easily be discovered by the naked eye. The greatest part, however, consist of quartz and mica; which substances are the most fit to be granulated, without being brought to a powder.

1. Cemented by clay.
   a. With an apyrous or refractory clay. This is of a loose texture; but hardens, and is very refractory in the fire.
   b. With common clay.
2. With lime; resembles mortar made with coarse sand.
   a. Consisting of transparent and greenish grains of quartz and white limestone.
   b. Of no visible particles. This is of a loose texture, and hardens in the air.
3. With an unknown cement.
   a. Loose.
   b. Harder.
   c. Compact.
   d. Very hard.
4. Cemented by the rust or ochre of iron. Is found in form of loose stones at several places, and ought perhaps to be reckoned among the *mineræ arenaceæ* or sand ores; at least when the martial ochre makes any considerable portion of the whole.
5. Grit-stone. This is of greater or less hardness, mostly of a grey, and sometimes of a yellowish colour; composed of a siliceous and micaceous sand, and rarely of a sparry kind, with greater or lesser particles closely compacted and united by an argillaceous cement. It gives some sparks with steel, is indissoluble for the most part in acids, and vitrifiable in a strong fire. It is used for millstones and whetstones, sometimes for filtering stones and for building. *Fabroni.*

   N. B. The *argillaceous* grit has been before described, p. 89. col. 1.
6. Elastic. A singular species of sandstone, of which a specimen was shown some years ago to the Royal Academy of Sciences at Paris by the Baron de Dietrich. It is flexible and elastic; and consists of small grains of hard quartz, that strike fire with tempered steel, together with some micaceous mixture. The elasticity seems to depend on the micaceous part, and softness of the natural gluten between both. It is said, that this elastic stone was found in Brazil, and brought to Germany by his excellency the Marquis de Lavradio.

   There are also two tables of white marble, kept in the palace Borghese at Rome, which have the same property. But the sparry particles of their substance, though transparent, are rather soft; may be easily separated with the nail, and effervesce with aqua-fortis; and there is also in it a little mixture of small particles of talc or mica. See *Journ. de Phys.* for Oct. 1784, p. 275. See also the article Marble (*Elastic.*)

C. Stones and ores cemented together; *Mineræ arenaceæ*.

1. Of larger fragments.
   a. Mountain green, or *viride montanum cupri*, and pebbles cemented together, from Siberia.
   b. Potters lead-ore, with limestone, slate-kernels, and shells.
   c. Yellow or marcasitical copper ore, with small pebbles.
2. Of smaller pieces.
   a. Potter's lead-ore with a quartzose sand.
   b. Mountain green with sand from Siberia.
   c. Cobalt ore with sand.
   d. Martial ochre with sand.

Order II. Mineral changes, or Petrifactions.

These are mineral bodies in the form of animals or vegetables, and for this reason no others belong to this order than such as have been really changed from the subjects of the other two kingdoms of nature.

I. Earthy changes; *Terræ larvatæ*.

A. Extraneous bodies changed into a lime substance, or calcareous changes; *Larvæ calcareæ*.

(1.) Loose or friable. Chalky changes; *Cretæ larvatæ*.

a. In

neral Wade cut a fine military road upon the south side of the lake, at a great expence of time, labour, and gunpowder. These rocks are seen stretching through the mountains of Stratherig into Badenoch, where it forms a remarkable rock and precipice called *Craigdow* or the *Black Rock*. The same range is again seen farther towards the south-west, in several places to the south of the Black Mount, and in the country of Glenorchy in Argyleshire: and Mr Williams supposes, that the longitudinal line of this rock, so far as it has been just pointed out, is little less than 200 miles, and in some places it spreads eight or ten miles in what may be called the latitudinal line across the bearing of the rocks.

a. In form of vegetables.
b. In form of animals.
1. Calcined or mouldered shells; *Humus conchaceus.*
(2.) Indurated; *Petrifacta calcarea.*
a. Changed and filled with solid limestone.
1. In form of animals.
2. In form of vegetables.
b. Changed into a calcareous spar; *Petrifacta calcarea spatosa.*
1. In form of animals.
2. In form of vegetables.
B. Extraneous bodies changed into a flinty substance. Siliceous changes; *Larvæ silicea.* These are, like the flint,
(1.) Indurated.
a. Changed into flints.
1. Carnelians in form of shells, from the river Tomm in Siberia.
2. Agat in form of wood. Such a piece is said to be in the collection of Count Tessin.
3. Coralloids of white flint, (*Millepora.*)
4. Wood of yellow flint.
C. Extraneous bodies changed into clay. Argillaceous changes; *Larvæ argillaceæ.*
A. Loose and friable.
1. Of porcelain clay.
a. In form of vegetables.

A piece of white porcelain clay from Japan, with all the marks of the root of a tree, has been observed in a certain collection.

B. Indurated.
1. In an unknown clay.
a. In form of vegetables. *Osteocolla.* It is said to be changed roots of the poplar tree, and not to consist of any calcareous substance.

A sort of fossile ivory is said to be found, which has the properties of a clay; but it is doubtful if it has been rightly examined.

II. Saline extraneous bodies, or such as are penetrated by mineral salts. *Corpora peregrina insalita. Larvæ insalitæ.*
A. With the vitriol of iron.
1. Animals.
a. Human bodies have been twice found in the mine at Falun in Dalarne; the last was kept a good many years in a glass-case, but began at last to moulder and fall to pieces.
2. Vegetables.
a. Turf, and
b. Roots of trees.

These are found in water strongly impregnated with vitriol. They do not burn with a flame, but only like coal in a strong fire; neither do they decay in the air.

III. Extraneous bodies penetrated by mineral inflammable substances, or mineral phlogiston.
A. Penetrated by the substance of pit-coals.
1. Vegetables, which commonly have been woods, or appertaining to them.
a. Fully saturated. *Gagas,* Jet. (See p. 104. col. 2.) The jet is of a solid shining texture.
b. Not perfectly saturated; *Mumia vegetabilis.* It is loose; resembles umber, and may be used as such.
B. Penetrated by rock-oil or asphaltum.
1. Vegetables.
a. Turf.

The Egyptian mummies cannot have any place here, since art alone is the occasion that those human bodies have in length of time been penetrated by the asphaltum, in the same manner as has happened naturally to the wood in pit-coal strata. See MUMMY.

C. Penetrated by sulphur which has dissolved iron, or by marcasite and pyrites. *Pyrite impregnata. Petrifacta pyritacea.*
1. Animals.
a. Human.
b. Bivalves.
c. Univalves.
d. Insects.
IV. Metals in form of extraneous bodies; *Larvæ metalliferæ.*
A. Silver; *Larvæ argentiferæ.*
(1.) Native.
a. On the surfaces of shells.
(2.) Mineralised with copper and sulphur.
a. Fahlertz, or grey silver ore in form of ears of corn, &c. and supposed to be vegetables, are found in argillaceous slate at Frankenberg and Tahlitteren in Hesse.
B. Copper; *Larvæ cupriferæ.*
(1.) Copper in form of calx.
a. In form of animals, or of parts belonging to them.
1. Ivory and other bones of the elephant. The Turcois or Turquoise; which is of a bluish green colour, and much valued in the east.

At Simore in Languedoc bones of animals are dug, which during the calcination assume a blue colour; but it is not probable that the blue colour is owing to copper.

(2.) Mineralised copper, which impregnates extraneous bodies; *Cuprum mineralisatum corpora peregrina ingressum.*
A. With sulphur and iron. The yellow or marcasitical copper ore that impregnates,
1. Animals.
a. Shells.
b. In form of fish.
B. With sulphur and silver. Grey silver ore or fahlerts, like ears of corn, from the slate-quarries in Hesse.
C. Changes into iron; *Larvæ ferriferæ.*
(1.) Iron in form of calx, which has assumed the place or the shape of extraneous bodies; *Ferrum calciforme corpora peregrina ingressum.*
a. Loose; *Larvæ ochraceæ.*
1. Of vegetables.

Roots of trees, from the lake Langelma in Finland. See the acts of the Swedish Academy of Sciences for the year 1742.

b. Indu-

b. Indurated; *Larvæ hæmatiticæ.*

1. Of vegetables.

(2.) Iron mineralised, assuming the shape of extraneous bodies.

a. Mineralised with sulphur. Marcasite. *Larvæ pyritaceæ.*

V. Extraneous bodies decomposing, or in a way of destruction; *Corpora peregrina in gradibus destructionis considerata.* Mould; *Humus.* Turf; *Turba.*

A. From animals. Animal-mould; *Humus animalis.*

1. Shells. *Humus conchaceus.*

2. Mould of other animals; *Humus diversorum animalium.*

B. Vegetable mould; *Humus vegetabilis.*

1. Turf; *Turba.*

a. Solid, and hardening in the air; *Turba solida aere indurescens.* This is the best of the kind to be used for fuel, and comes nearest to the pit-coals. It often contains a little of the vitriolic acid.

b. Lamellated turf; *Turba foliata.* This is in the first degree of destruction.

2. Mould of lakes; *Humus lacustris.* This is a black mould which is edulcorated by water.

3. Black mould; *Humus ater.* This is universally known, and covers the surface of that loose earth in which vegetables thrive best.

Order III. Volcanic Products (H).

I. Slags; *Scoriæ vulcanorum.*

Slags are found in great abundance in many places of the world, not only where volcanoes yet exist, but likewise where no subterraneous fire is now known: Yet, in Mr Cronstedt's opinion, they cannot be produced but by means of fire. These are not properly to be called *natural,* since they have marks of violence, and of the last change that mineral bodies can suffer without the destruction of the world; nor are they *artificial,* according to the universally received meaning of this word. We cannot, however, avoid giving them a place here, especially after having admitted the petrifactions; and shall therefore arrange the principal of them, according to their external marks.

A. Iceland agate; *Achates islandicus niger.*

It is black, solid, and of a glassy texture; but in thin pieces it is greenish and semitransparent like glass-bottles, which contain much iron. The most remarkable circumstance is, that such large solid masses are found of it, that there is no possibility of producing the like in any glass-house.

It is found in Iceland, and in the island of Ascension: The jewellers employ it as an agate, though it is too soft to resist wear.

B. Rhenish millstone; *Lapis molaris Rhenanus.*

Is blackish-grey, porous, and perfectly resembles a sort of slag produced by mount Vesuvius. A variety of lava, according to Kirwan.

C. Pumice-stone; *Pumex.*

It is very porous and blistered, in consequence of which it is specifically very light. It resembles that frothy slag which is produced in our iron furnaces.

1. White.

2. Black.

The colour of the first is perhaps faded or bleached, because the second kind comes in that state from the laboratory itself, *viz.* the volcanoes.

D. Pearl slag; *Scoriæ constantes globulis vitreis conglomeratis.*

It is compounded of white and greenish glass particles, which seem to have been conglutinated while yet soft or in fusion. Found on the Isle of Ascension.

E. Slag-sand or ashes; *Scoriæ pulverulentæ, cineres vulcanorum.*

This is thrown out from volcanoes in form of larger or smaller grains. It may perhaps be the principle of the Terra Puzzolana; because such an earth is said at this time to cover the ruins of Herculaneum near Naples, which history informs us was destoyed by a volcano during an earthquake.

II. Lavas.

Lava has been generally understood to denote the aggregate mass of melted matters which flow out of the mouths, or burst out from the sides, of burning mountains. According to Mr Kirwan, however, lavas are the immediate produce of liquefaction or vitrification by the volcanic fires, and "should carefully be distinguished from the subsequent productions affected by the water either in a liquid or fluid state, which generally is ejected at the same time." And of lavas, so distinguished, he describes several varieties. See the article Lava, in the order of the alphabet; where the nature, origin, kinds, and phenomena of lavas, are copiously described and explained.

III. Basaltes.

This sort of stone was by Cronstedt, in the first edition of his Mineralogy, ranked among the garnet earths, and confounded with the shoerls; an impropriety which was pointed out by Bergman in his *Sciagraphia,* sect. 130.—Mr Kirwan considers basaltes as an imperfect lava, and ascribes its origin both to fire and water. He describes it as found, either, 1. In opaque triangular or polyangular columns; which is the proper basaltes: Or, 2. In amorphous masses of different magnitudes; forming solid blocks, from the smallest size to that of whole mountains; which kind is called *trapp.* See the detached article Basaltes (I); where its species and varieties

(H) For the nature, history, theory, &c. of volcanoes, see the article Volcano.

(I) In that article, p. 46. col. 1. l. 9. *dele* the words, "The English miners call it *cockle,* the German *schoerl.*"—P. 47. col. 2. l. 28. for "a kind of marble," read "a volcanic production." The *Lapis Lydius,* or Touchstone, mentioned in the same paragraph, should have been specified to be of the sort called *Trapp.*

rieties are particularly defcribed, and different opinions ftated concerning its formation. See alfo the article TRAPP.—Some plaufible arguments againft the volcanic origin of bafaltes will be mentioned in the courfe of the fubjoined note (K), extracted from *Williams's Natural Hiftory of the Mineral Kingdom*.

(K) There is a great variety of bafaltes in Scotland, particularly of the grey kinds; fome of which are capable of the higheft degree of polifh. A good black kind is met with on the fouth fide of Arthur's Seat near Edinburgh, where it forms a fmooth perpendicnlar rock, with feveral of the columns broken off, and the fufpended pieces threatening to fall down upon the paffengers below. This ftone is capable of receiving a fine polifh; and, in the opinion of Mr Williams, would be fit for all forts of ornaments about fepulchral monuments. It will polifh to a bright and beautiful black, which will be unfading.

There is another kind, heavy and hard, of a black or blackifh-grey colour; of which great quantities have been carried from the Frith of Forth to pave the ftreets of London. This, for the moft part, is coarfely granulated in the infide, though fometimes the grain is pretty fine. Sometimes it is bright in the infide when broken. It is compofed of grains of quartz and fhirl of different fizes, and commonly contains fome iron. It always appears in thick, irregular, beds, fome of which are enormoufly thick; and feldom or ever equally fo: on the contrary, where it is found uppermoft, it frequently fwells into little hills of various fizes. Moft of the fmall iflands in the Frith of Forth are compofed of this kind of ftone; as well as fome hills in the neighbourhood of Inverkeithing and of Edinburgh.

The known characteriftic of the bafaltes is to form itfelf into balls, columns, and other regular figures. The columnar kind affumes a pentagonal, hexagonal, or heptagonal figure; but quadrangular columns are not common. They are all fmooth on the outfide, and lie parallel and contiguous to one another; fometimes perpendicular, fometimes inclining, in proportion to the pofition of the ftratum which is thus divided: If the ftratum lies horizontal, the columns are perpendicular; if inclining, the pillars alfo incline in exact proportion to the declivity of the ftrata, being always broken right acrofs the ftratum. Some are of one piece from top to bottom; others divided by one or more joints laid upon one another, which form a column of feveral parts. The rock called the *Giant's Caufeway* in Ireland is a pretty good fpecimen of the jointed columnar bafaltes: but there is a more beautiful fpecies above Hillhoufe lime-quarry, about a mile fouth of Linlithgow in Scotland; and a coarfer one near the toll-bar north fide of Queen's Ferry, and feveral other places in Fife. In fome places the bafaltes are formed into magnificent columns of great length; and in others afford an affemblage of fmall and beautiful pillars refembling a range of balluftrades or organ pipes. Some of the columns on the fouth fide of Arthur's Seat already mentioned are very long; and there are likewife magnificent columns of great length in the ifland of Egg, and others of the Hebrides. Thefe columns, when broken, are frequently of a black, or blackifh grey, in the infide; fome of them being compofed of fmall grains, which gives them an uniform and fmooth texture; but much of this fpecies of ftone has larger grains in its compofition, rough, fharp, and unequal, when broken. All the grains, however, are fine, hard, and bright; and the ftone in general is capable of a fine polifh.

The other fpecies of bafaltes which forms itfelf into diftinct maffes, affumes fometimes a quadrangular, fometimes an oval, globular, or indeterminate figure. They are found of all fizes from the fize of an egg to that of an houfe: but though they differ in fhape from the columnar bafaltes, they agree in almoft every other refpect; whence Mr Williams thinks that they are only to be accounted a variety of the columnar kind. It is common to fee one ftratum of the bafaltine rocks exhibiting, in one place, regular pillars or globes; and near thefe, very irregular ones, differing very little from the common cutters found in all rocks; and at no great diftance, the fame rock is found to run into one entire mafs, exhibiting no tendency to be broken or divided into any columns whatever. Of this the rock of Arthur's Seat is an inftance. Some of thefe only produce folid maffes of different figures and fizes; while others produce quantities of a fofter, friable, ftony matter, of the fame quality in which the hard maffes of different figures are found imbedded. Pretty good fpecimens of the fecond kind or variety of bafaltes are met with on the road-fide between Cramond bridge and the Queen's Ferry, and in feveral other places in the Lothians and in Fife.

The cruftated bafaltes are of two kinds; 1. Such as have the crufts more dry and friable than the internal parts; and, 2. Such as are dry and friable throughout the whole mafs.

The firft of thefe has not only a cruft of the friable matter adhering to it, but is likewife imbedded in a quantity of the fame. Our author has feen many quarries of this kind of bafaltes dug for the high roads, in which the quantity of foft friable matter greatly exceeded that of the hard maffes, and in which incrufted ftones of various fizes and fhapes appeared. In fuch quarries, fome of the largeft maffes have only a few coats of penetrable friable matter, furrounding a nucleus which varies in fize, but is uniformly hard throughout; and we fhall find other yolks in the fame quarry imbedded in the fofter matter, which, when broken, exhibit a neft of ftones including one another like the feveral coats of an onion. Thefe cruftated bafaltes which envelope one another are a curious fpecies of ftone. The feveral coats of furrounding matter differ nothing in quality from the ftones contained in them, and fome of the inner crufts are often very hard; but the nucleus within, though fmall, is always the hardeft. The decompofition by the weathering of the fofter matter found furrounding and enveloping the harder maffes of ftone in this and the fecond fpe-

Appendix. VOLCANIC PRODUCTS

cies of basaltine rocks, has produced a phenomenon frequently met with in Great Britain, especially in Scotland, which greatly puzzles many. It is very common in low grounds, and upon some moderate eminences, to see a prodigious multitude of stones of all shapes and sizes, very hard, and pretty smooth on the outside. These stones are sometimes so numerous and large, that it is often found impracticable to clear a field of them. Where those stones are a species of basaltes, which they commonly are, and of the second species of basaltes described above, they alway originate from a decomposition of the more soft or friable parts of those rocks, which moulder or fall away, and leave the harder stones detached and scattered about, and the decomposed matter dissolves by degrees, and becomes good corn mould.

Here Mr Williams takes occasion to contest the opinion of those who think that stones grow or vegetate like plants. He owns indeed that they increase in bulk: but this, he says, is only in such situations as are favourable for an accretion of matter carried down and deposited by the water; in all other situations they grow less and less. "Others (says he) imagine, that these stones (on which this extraneous matter has been deposited) were rolled about; that the asperities and sharp angles were by that means worn off; and that they were all at last deposited as we see them, by the waters of the universal deluge: and, having their obtuse sides and angles, as if they had been rounded by rolling in water, makes these gentlemen confident that they are right; and if we did not frequently find stones exactly of the same figure, size, and quality in the rock, it would be very difficult to overthrow this hypothesis. I have taken great pains to investigate this point, having frequently examined circumstances; and never failed to discover the stratum of rock which those detached stones originally belonged to. "The strata or beds of the several species of basaltes spread as wide, and stretch as far, as the other concomitant strata in the neighbourhood where they are found: but they often lie very flat, or with a moderate degree of declivity; and consequently, when the softer and more friable matter found in the interstices of these rocks, which incloses and binds the harder masses in their native beds, is decomposed, the harder stones must then lie scattered wide upon the face of the ground."

The second species of the crustated basaltes, viz. that which is dry and friable throughout the whole mass, is generally of a coarse and granulated texture, and of all the various shades of grey colours; from a rusty black to a light-coloured grey. This kind of crustated basaltes is developed when the masses are either broken or in a state of decomposition; and there are masses of it of all sizes and shapes found in the rocks, resembling the second and third species of the basaltes; appearing alike smooth on the outside, with obtuse angles; in short, resembling the basaltes in every respect: but when they are exposed to the external air and weather for any considerable time, the several incrustations decay, decompose, and crumble down by degrees. When they quarry this species of basaltes for the roads, they are able to break and pound them small with ease; but the harder species are so hard and cohesive, that they are with the greatest difficulty broken into sufficiently small parts.

Composite basaltes resembles the three last species, in figure, colour, and all other external appearances; being distinguishable from them only in the internal structure or grain of the stone. It resembles some of the granites, as consisting of much larger grains than the other basaltes. Many of the larger grains in the composite basaltes are more than an eighth part of an inch over, and some more than a fourth; appearing with smooth flat surfaces, and of a tabulated texture, exactly resembling the quartzy grains so commonly found in the composition of most of the granites. The chief, if not the only, distinguishable difference between the grains in each of them is the colour. They are evidently large grains of quartz, &c. which exhibit flat shining surfaces in both. Those grains or fragments are commonly white, yellowish, red, or black, in the composition of most of the granites; whereas they are often seen of a pale blue, or a bluish grey colour, in the composite basaltes, and some of them approaching to white. It is only in the *internal* structure, however, that these basaltes have any resemblance to the granites; in all the external characters, they differ nothing from the rest of their own genus.

A fifth species of basaltes is indurated through the whole stratum, solid and uniform through all its parts, and exhibiting only such cracks and fissures or cutters as are commonly met with in other hard beds of stones. Many beds of this species are frequently met with in the coal-fields, and the miners are often obliged to sink through them in their coal-pits. "The Salisbury craigs at Edinburgh (says our author) might be singled out as a good example of this species of stone, were it not that part of the same stratum is formed into columns on Arthur's seat; though, I believe, this is no good exception, as it evidently appears that the beds of basaltes which are formed into columns, glebes, &c. only assume these figures where they are exposed to the influence of the external air, or have but little cover of rock above them. When any of those beds strike deep under the cover of several other strata, they are not found in columns, &c. Nothing but an uniform mass then appears, although the same bed is regularly formed near the surface; which proves that the columnar and other basaltes are formed by shrinking and chapping.

"The strata of basaltes spread as wide, and stretch as far in the longitudinal bearing, as the other different strata which accompany them in the countries where they are found. The rocks of basaltes also are generally found in very thick strata; and that generally in places where no other rock is found above the basaltes, the strata of it are often very unequal in thickness. But this, in general, is only in situations where no other rock is found above it; for when it fairly enters into the surface of the earth, so as to have other regular strata above it, which is seen in an hundred places in the Lothians, Fife, and other parts of Scotland, it then appears pretty equal in thickness, as equal as most other beds of such great thickness are; and yet it is remarkable, that although most of the strata of basaltes are of great thickness, there are frequently thin

Appendix. Volcanic Products

ſtrata of various kinds found both above and below it. We have numerous examples of this in all the parts of Scotland where baſaltes is found; as for inſtance, there are thin and regular ſtrata ſeen and quarried both above and below the thick bed of that rock in the Saliſbury craigs near Edinburgh. In the Bathgate hills, ſouth of Linlithgow, and in many other parts of Scotland, there are ſeveral ſtrata of baſaltes, and likewiſe of coal, limeſtone, freeſtone, and other concomitants of coal blended promiſcuouſly *ſtratum ſuper ſtratum;* and the baſalt is frequently found immediately above, and immediately below regular ſtrata of coal; of courſe baſaltes *is not the lava of volcanoes.* We can prove to ocular demonſtration, from the component parts, and from the ſituation, ſtretch, and bearing of the ſtrata of baſaltes, that they are real beds of ſtone, coeval with all the other ſtrata which accompany them; and are blended with them in the ſtructure of that part of the globe where they are found, as they dip and ſtretch as far every way as the other ſtrata found above and below them. If baſaltes, therefore, be a volcanic production, the other ſtrata muſt of neceſſity be ſo likewiſe. But how volcanoes ſhould produce coal, and how that coal ſhould come into contact with burning lava, is not a little problematical; or rather it is ſtrangely abſurd to imagine that burning lava can come into contact with coal without deſtroying it.

The regularly ſtratified quartzy white-mountain rock is ſcarce or rather not to be found in moſt parts of Britain. In the Highlands, however, it is very common; and in ſome places of them Mr Williams has ſeen it ſtratified as regularly as any of the ſand-ſtones, with other regular ſtrata of different qualities immediately above and below it; and ſometimes compoſing large and high mountains entirely of its own ſtrata. This ſtone is exceedingly hard, dry, and brittle, full of cracks and ſharp angles; the different ſtrata ſometimes moderately ſolid, but often naturally broken into ſmall irregular maſſes, with angles as ſharp as broken glaſs, and of an uniformly fine and granulated texture, reſembling the fineſt ſugar-loaf. There are large and high mountains of this ſtone in Roſsſhire and Inverneſsſhire, which, in a clear day, appear at a diſtance as white as ſnow, without any ſort of vegetation on them except a little dry heath round the edge of the hill.

Minerva.

MINERVA, or PALLAS, in Pagan worſhip, the goddeſs of ſciences and of wiſdom, ſprung completely armed from Jupiter's brain; and on the day of her nativity it rained gold at Rhodes. She diſputed with Neptune the honour of giving a name to the city of Athens; when they agreed that whoſoever of them ſhould produce what was moſt uſeful to mankind, ſhould have that advantage. Neptune, with a ſtroke of his trident, formed a horſe; and Minerva cauſed an olive to ſpring from the ground, which was judged to be moſt uſeful, from its being the ſymbol of peace. Minerva changed Arachne into a ſpider, for pretending to excel her in making tapeſtry. She fought the giants; favoured Cadmus, Ulyſſes, and other heroes; and refuſed to marry Vulcan, chooſing rather to live in a ſtate of celibacy. She alſo deprived Tireſias of ſight, turned Meduſa's locks into ſnakes, and performed ſeveral other exploits.

Minerva is uſually repreſented by the poets, painters, and ſculptors, completely armed, with a compoſed but agreeable countenance, bearing a golden breaſt-plate, a ſpear in her right-hand, and her ægis or ſhield in the left, on which is repreſented Meduſa's head encircled with ſnakes, and her helmet was uſually entwined with olives.

Minerva had ſeveral temples both in Greece and Italy. The uſual victim offered her was a white heifer, never yoked. The animals ſacred to her were the cock, the owl, and the baſiliſk.

MINERVÆ Caſtrum, Arx Minervæ, Minervium, or *Templum Minervæ,* (anc. geogr.), a citadel, temple, and town on the Ionian ſea, beyond Hydrus; ſeen a great way out at ſea. Now *Caſtro,* a town of Otranto in Naples. E. Long. 19. 25. N. Lat. 46. 8.

MINERVÆ Promontorium (anc. geogr.), the ſeat of the Sirens, a promontory in the Sinus Paeſtanus, the ſouth boundary of Campania on the Tuſcan coaſt; ſo called from a temple of Minerva on it: ſituated to the ſouth of Surrentum, and therefore called *Surrentinum.* Now *Capo della Minerva,* on the weſt coaſt of Naples, over-againſt the iſland Capri.

Minervalia Mingrelia.

MINERVALIA, in Roman antiquity, feſtivals celebrated in honour of Minerva, in the month of March; at which time the ſcholars had a vacation, and uſually made a preſent to their maſters, called from this feſtival *Minerval.*

MINGRELIA, anciently COLCHIS, a part of Weſtern Georgia, in Aſia; bounded on the eaſt by Iberia, or *Georgia* properly ſo called; on the weſt, by the Euxine Sea; on the ſouth, by Armenia, and part of Pontus; and on the north, by Mount Caucaſus.

Colchis, or Mingrelia, is watered by a great many rivers; as the Corax, the Hippus, the Cyaneus, the Chariſtus, the Phaſis, where the Argonauts landed, the Abſarus, the Ciſſa, and the Ophis, all emptying themſelves into the Euxine Sea. The Phaſis does not ſpring from the mountains in Armenia, near the ſources of the Euphrates, the Araxes, and the Tigris, as Strabo, Pliny, Ptolemy, Dionyſius, and after them Arrian, Reland, Calmet, and Sanſon, have falſely aſſerted; but riſes in Mount Caucaſus; and flows not from ſouth to north, but from north to ſouth, as appears from the map of Colchis or Mingrelia in Thevenot's collection, and the account which Sir John Chardin gives of that country. This river forms in its courſe a ſmall iſland called alſo *Phaſis;* whence the pheaſants, if Iſidorus is to be credited, were firſt brought to Europe, and thence called by the Greeks *Phaſiani.* The other rivers of Colchis are conſiderable.

The whole kingdom of Colchis was in ancient times very pleaſant and fruitful, as it is ſtill where duly cultivated; abounded in all the neceſſaries of life; and was enriched with many mines of gold, which gave occaſion to the fable of the Golden Fleece and the Argonautic expedition ſo much celebrated by the ancients.

Mingrelia.

Sir John Chardin tells us, that this country extends above 100 miles in length and 60 in breadth; being not near so extensive as the ancient Colchis, which reached from the frontiers of Iberia or Georgia Proper, westward to the Palus Mæotis: that it is beautifully diversified with hills, mountains, valleys, woods, and plains, but badly cultivated: that there are all the kinds of fruits which are found in England, growing wild, but tasteless and insipid for want of culture: that, if the natives understood the art of making wines, those of this country would be the finest in the world: that there are many rivers which have their source in Mount Caucasus, particularly the Phasus, now called the *Rione:* that the country abounds in beeves, hogs, wild boars, stags, and other venison; and in partridges, pheasants, and quails: that falcons, eagles, pelicans, lions, leopards, tigers, wolves, and jackals, breed on Mount Caucasus, and sometimes greatly annoy the country: that the people are generally handsome, the men strong and well made, and the women very beautiful; but both sexes very vicious and debauched: that they marry their nieces, aunts, or other relations, indifferently; and take two or three wives if they please, and as many concubines as they will: that they not only make a common practice of selling their children, but even murder them, or bury them alive, when they find it difficult to bring them up: that the common people use a sort of paste, made of a plant called *gom*, instead of bread; but that of the better sort consists of wheat, barley, or rice: that the gentry have an absolute power over their vassals, which extends to life, liberty, and estate: that their arms are the bow and arrow, the lance, the sabre or broad-sword, and the buckler: that they are very nasty; and eat sitting cross-legged upon a carpet, like the Persians; but the poorer sort upon a mat or bench, in the same posture: that the country is very thin of inhabitants, no less than 12,000 being supposed to be sold yearly to the Turks and Persians: that the principal commodities exported from it are, honey, wax, hides, castor, martin-skins, flax-seed, thread, silk, and linen-cloth; but that there are no gold or silver mines now, and very little money: that the revenue of the prince or viceroy amounts to about 20,000 crowns *per annum:* that the inhabitants call themselves *Christians;* but that both they and their priests are altogether illiterate, and ignorant of the doctrines and precepts of Christianity: that their bishops are rich, have a great number of vassals, and are clothed in scarlet and velvet: and that their service is according to the rites of the Greek church, with a mixture of Judaism and Paganism.

The cities of most note in this country in ancient times were Pityus; Dioscurias, or Dioscorias, which was so called from Castor and Pollux, two of the Argonauts, by whom it is supposed to have been founded, and who in Greek are styled *Dioscuroi*, at present known by the name of *Savatapoli;* Aea on the Phasis, supposed to be the same as Hupolis; *Phasis*, so called from the river on which it stood; Cyta, at the mouth of the river Cyaneus, the birth-place of the famous Medea, called from thence, by the poets, *Cytæis;* Saracæ, Zadris, Surium, Madia, and Zolissa. As for modern cities, it does not appear that there are any here considerable enough to merit a description; or, if there are, they seem to be little, if at all, known to Europeans.

Minho, Miniature.

MINHO, a great river in Spain, which taking its rise in Galicia, divides that province from Portugal, and falls into the Atlantic at Caminha.

MINIATURE, in a general sense, signifies representation in a small compass, or less than the reality.

MINIATURE-PAINTING;

A DELICATE kind of painting, consisting of little points or dots; usually done on vellum, ivory, or paper, with very thin, simple water-colours. —The word comes from the Latin *minium*, "red-lead;" that being a colour much used in this kind of painting. The French frequently call it *mignature*, from *mignon*, "fine, pretty," on account of its smallness and delicacy: and it may be ultimately derived from μικρος "small."

Miniature is distinguished from other kinds of painting by the smallness and delicacy of its figures and faintness of the colouring; on which account it requires to be viewed very near.

Sect. I. *Of Drawing and Designing.*

To succeed in this art, a man should be perfectly skilled in the art of designing or drawing: but as most people who affect the one, know little or nothing of the other, and would have the pleasure of painting without giving themselves the trouble of learning to design (which is indeed an art that is not acquired without a great deal of time, and continual application), inventions have been found out to supply the place of it; by means of which a man designs or draws, without knowing how to design.

The first is chalking: that is, if you have a mind to do a print or design in miniature, the backside of it, on another paper, must be blackened with small-coal, and then rubbed very hard with the finger wrapped in a linen cloth: afterwards the cloth must be lightly drawn over the side so blackened that no black grains may remain upon it to soil the vellum you would paint upon; and the print or draught must be fastened upon the vellum with four pins, to keep it from shifting. And if it be another paper that is blackened, it must be put between the vellum and the print, or draught, with the blackened side upon the vellum. Then, with a blunted pin or needle, you must pass over the principal lines or strokes of the print, or draught, the contours, the plaits of the drapery, and over every thing else that must be distinguished; pressing so hard, that the strokes may be fairly marked upon the vellum underneath.

Copying by squares is another convenient method for such as are but little skilled in the art of designing, and would copy pictures, or other things, that cannot be chalked. The method is this: The piece must be divided

Drawing and Designing.

divided into many equal parts by little ſquares, marked out with charcoal, if the piece be clear and whitiſh, and the black can be fairly ſeen upon it; or with white chalk, if it be too brown and duſky. After which, as many ſquares of equal dimenſions muſt be made on white paper, upon which the piece muſt be deſigned; becauſe, if this be done immediately upon vellum, (as one is apt to miſcarry in the firſt attempt), the vellum may be ſoiled with falſe touches. But when it is neatly done upon paper, it muſt be chalked upon the vellum in the manner before deſcribed. When the original and the paper are thus ordered, obſerve what is in each ſquare of the piece to be deſigned; as a head, an arm, a hand, and ſo forth; and place it in the correſponding part of the paper. And thus finding where to place all the parts of the piece, you have nothing to do but to form them well, and to join them together. By this method you may reduce or enlarge a piece to what compaſs you pleaſe, making the ſquares of your paper greater or leſs than thoſe of the original; but they muſt always be of an equal number.

To copy a picture, or other thing, in the ſame ſize and proportion, another method is, to make uſe of varniſhed paper, or of the ſkin of a hog's bladder, very tranſparent, ſuch as is to be had at the gold-beaters. Talc or iſinglaſs will likewiſe do as well. Lay any one of thoſe things upon your piece; through it you will ſee all the ſtrokes and touches, which are to be drawn upon it with a crayon or pencil. Then take it off; and faſtening it under paper or vellum, ſet up both againſt the light in the manner of a window; and with a crayon, or a ſilver needle, mark out upon the paper or vellum you have put uppermoſt, all the lines and touches you ſhall ſee drawn upon the varniſhed paper, bladder, talc, or iſinglaſs, you have made uſe of, and which will plainly appear through this window.

After this manner, making uſe of the window, or of glaſs expoſed to the light, you may copy all ſorts of prints, deſigns, and other pieces, on paper or vellum; laying and faſtening them under the paper or vellum upon which you would draw them. And it is a very good and a very eaſy contrivance for doing pieces of the ſame ſize and proportion.

If you have a mind to make pieces look another way, there is nothing to be done but to turn them; laying the printed or drawn ſide upon the glaſs, and faſtening the paper or vellum upon the back of it; remembering to let your lights fall on the left ſide.

A good method likewiſe to take a true copy of a picture in oil, is to give a touch of the pencil upon all the principal ſtrokes, with lake tempered with oil; and to clap upon the whole a paper of the ſame ſize: then paſſing the hand over it, the touches of the lake will ſtick and leave the deſign of your piece expreſſed upon the paper, which may be chalked like other things. But you muſt remember to take off with the crumb of bread what remains of the lake upon the picture before it be dry.

You muſt likewiſe make uſe of pounce, made of powdered charcoal put in a linen-rag; with which the piece you would copy muſt be rubbed, after you have pricked all the principal ſtrokes or touches, and faſtened white paper or vellum underneath.

But a ſurer and eaſier help than all theſe, for one who knows nothing of deſigning, is a mathematical compaſs; it is generally made of ten pieces of wood, in form of rulers, half a quarter of an inch thick, half an inch broad, and a foot long, or more, according as you have a mind to draw pieces of a greater or leſs ſize. To facilitate the conſtruction of this inſtrument, a figure is given, with an explanation of the manner in which it is to be uſed.

Plate CCCXIV.

The little board A is to be of fir, and covered with linen or any other cloth; becauſe the piece you copy, and the vellum or paper you copy upon, muſt be fixed upon it. Upon this board muſt the compaſs alſo be fixed with a pin, by the end of the firſt foot B, deep enough to keep it cloſe, but not ſo deep as to hinder it from turning eaſily. When you have a mind to reduce things, place your original on the ſide of the foot C, and the vellum or paper you would draw upon on the ſide of the foot B; removing the vellum, or drawing it nearer, according as you intend to reduce or enlarge.

In order to enlarge a piece, you have nothing to do but to change the places of your original and your copy; placing the laſt towards C, and the other on the ſide of B.

And in both one and the other method, a crayon or leaden needle muſt be put in the foot under which the vellum lies; and a pin, a little blunted, in that over the original, with which all the traces are to be followed; conducting the pin with one hand, and with the other preſſing gently upon the crayon or needle that marks the vellum. When the crayon or needle bears ſufficiently upon the vellum, you have no occaſion to touch it.

By this inſtrument you may alſo draw in equal dimenſions: but in order to this, the compaſs muſt be fixed in another manner upon the board; for if it is to be faſtened upon it by the middle at D, your original and your copy muſt be fixed on each ſide of this middle foot, at the equal diſtances, or from corner to corner; that is, from C to E, when the pieces are large. One may likewiſe draw ſeveral copies at once of equal and different dimenſions.

When your piece is marked out upon the vellum, you muſt paſs with a pencil of very clear carmine over all the traces, to the end they may not be effaced as you work: then clean your vellum with the crumb of bread, that no black may remain upon it.

Your vellum muſt be paſted upon a little plate of braſs or wood, of the ſize you would make your piece, to keep it firm and tight: but this paſting muſt be on the edges of your vellum only, and behind the plate; for which purpoſe your vellum muſt exceed your plate above an inch on every ſide: for the part you paint upon muſt never be paſted; becauſe it would not only give it an ill look, but you could not take it off if you would. Cut off the little ſhags and locks of the vellum; and wetting the fair ſide with a linen-cloth dipped in water, clap the other upon the plate with a clean paper between them: ſo much as hangs over muſt be paſted upon the back of the plate, drawing it equally on all ſides, and hard enough to ſtretch it well.

Sect. II. *Of Materials.*

The chief colours made uſe of for painting in miniature, are

Carmine.
Venice and Florence lake.

 Roſe

Colours, &c.

Rofe pink.
Vermilion.
Red-lead.
Brown red.
Red orpiment.
Ultramarine.
Verditer.
Indigo.
Gall-ftone.
Yellow-ochre.
Dutch pink.
Gamboge.
Naples yellow.
Pale mafticot.
Deep yellow mafticot.
Ivory-black.
Lamp black.
True Indian ink.
Biftre, or wood-foot.
Raw umber.
Burnt umber.
Sap-green.
Verdigrife.
Flake-white.
Crayons of all colours.
Gold and filver fhells.
Leaf-gold and leaf-filver.

The feven tranfparent colours, which are ufed where writing is feen through the colour.

Liquid:
- Lake.
- Blue.
- Yellow.
- Grafs-green.
- Dark-green.
- Purple-colour.
- Brown.

Moft of thefe colours neceffary for miniature-painting may eafily be prepared by attending to the directions given under the article *Colour-Making*.

As colours taken from earth and other heavy matter are always too coarfe be they never fo well ground, efpecially for delicate work, becaufe of a certain fand remaining in them; the fineft parts may be drawn out by diluting them with the finger in a cup of water. When they are well fteeped, let them fettle a while: then pour out the cleareft, which will be at top, into another veffel. This will be the fineft, and muft be let dry; and when it is ufed, muft be diluted with gum-water.

If you mix a little of the gall of an ox, a carp, or an eel, particularly of the laft, in green, black, grey, yellow, and brown, colours, it will not only take away their greafy nature, but alfo give them a luftre and brightnefs they have not of themfelves. The gall of eels muft be taken out when they are fkinned, and hung upon a nail to dry; and when you would ufe it, it muft be diluted with brandy; add a little of it mixed with the colour you have diluted already. This likewife makes the colour ftick better to the vellum, which it hardly does when it is greafy: moreover, this gall hinders it from fcaling.

Some colours are made clearer by fire; as yellow ochre, brown red, ultramarine, and umber: all others are darkened by it. But if you heat the faid colours with a fharp fire, they change; for the brown-red becomes yellow; yellow ochre becomes red; umber reddens alfo. Cerufs by fire takes the colour of citron, and is often called *mafticot*. Obferve, that yellow ochre heated, becomes more tender than it was, and fofter than brown red. Likewife brown red heated becomes fofter than fine yellow ochre. Both are very proper. The fineft and trueft ultramarine, heated upon a red-hot iron, becomes more glittering; but it waftes, and is coarfer and harder to work with in miniature.

All thefe colours are diluted in little cups of ivory, made on purpofe, or in fea-fhells, with water in which gum arabic and fugar-candy are put. For inftance, in a glafs of water put a piece of gum as big as a walnut, and half that quantity of fugar-candy. This laft hinders the colours from fcaling when they are laid on, which they generally do when they want it, or the vellum is greafy.

This gum-water muft be kept in a neat bottle corked; and you never muft take any out of it with a pencil that has colour upon it, but with a quill or fome fuch thing.

Some of this water is put in the fhell with the colour you would temper, and diluted with the finger till it be very fine. If it be too hard, you muft let it foften in the fhell with the faid water before you dilute it. Afterwards let it dry: and do thus with every colour, except lily-green, fap-green, and gamboge, which muft be tempered with fair water only. But ultramarine, lake, and biftre, are to be more gummed than other colours.

If you make ufe of fea-fhells, you muft let them fteep two or three days beforehand in water: then cleanfe them in boiling-hot water, mixed with vinegar, in order to carry off a certain falt, which otherwife fticks to them, and fpoils the colours that are put to them.

To know whether colours are fufficiently gummed, you have nothing to do but to give a ftroke of the pencil upon your hand when they are diluted, which dries immediately: if they chap and fcale, there is too much gum; if they rub out by paffing the finger over them, there is too little. It may be feen likewife when the colours are laid on the vellum, by paffing the finger over them. If they ftick to it like a powder, it is a fign there is not gum enough, and more muft be put to the water with which you temper them: but take care you do not put too much; for that makes the colour extremely hard and dry. It may be known likewife by their glueinefs and brightnefs: fo the more they are gummed, the darker they paint; and when you have a mind to give a greater ftrength to a colour than it has of itfelf, you have nothing to do but to give it a great deal of gum.

Provide yourfelf with an ivory pallet, very fmooth, as big as your hand; on one fide of which the colours for the carnation, or naked parts of a picture, are to be ranged in the following manner. In the middle put a great deal of white, pretty largely fpread; becaufe it is the colour moft made ufe of: and upon the edge, from the left to the right, place the following colours at a little diftance from the white.

Mafticot.
Dutch-pink.
Orpiment.

Yellow

Colours, &c.

Yellow ochre.
Green; composed of verditer, Dutch pink, and white, in equal quantities.
Blue; made of ultramarine, indigo, and white, to a great degree of paleness.
Vermilion.
Carmine.
Bistre, and
Black.

On the other side of the pallet, spread some white in the same manner as for the carnation. And when you have a mind to paint draperies, or other things, place near the white the colour you would make them of, in order to work, as shall be shown hereafter.

The use of good pencils is a great matter. In order to make a good choice, wet them a little; and if the hairs keep close together as you turn them upon the finger, and make but one point, they are good: but if they close not together, but make several points, and some are longer than others, they are good for nothing. When they are too sharp-pointed, with only four or five hairs longer than the rest, yet closing all together, they are, notwithstanding, good; but they must be blunted with a pair of scissars, taking care at the same time you do not clip away too much It is proper to have two or three sorts of them; the largest for laying the grounds and dead colouring, and the smallest for finishing.

To bring the hairs of your pencil to join close together and make a good point, you must often put the pencil just between your lips when you are at work; moistening and pressing it close with the tongue, even when there is colour upon it; for if there be too much, some of it is taken off by this means, and enough left for giving fine and equal touches. You need not apprehend this will do you any harm. None of the colours for miniature, except orpiment, when they are prepared, have either ill taste or ill quality. This expedient must especially be used for dotting, and for finishing, particularly the naked parts of a picture, that the touches may be neat and fair, and not too much charged with colour. As for draperies and other things, as well in dead colouring as in finishing, it is sufficient, in order to make the hairs of your pencil join well, and to unload it when it has too much colour, to draw it upon the edge of the shell, or upon the paper you must put upon your work to rest your hand on, giving some strokes upon it before you work upon your piece.

To work well in miniature, you must do it in a room that has but one window, and fix yourself very near it, with a table and desk almost as high as the window; placing yourself in such a manner, that the light may always come in on the left side, and never forward or on the right.

When you would lay a colour on all parts equally strong, as for a ground, you must make your mixtures in shells, and put in enough for the thing you design to paint; for if there be not enough, it is a great chance but the colour you mix afterwards is too dark or too light.

Sect. III. *Of Working.*

Of Working.

After having spoke of vellum, pencils, and colours, let us now show how they are to be employed. In the first place, then, when you would paint a piece, be it carnation, drapery, or any thing else, you must begin by dead colouring; that is to say, by laying your colours on with liberal strokes of the pencil, in the smoothest manner you can, as the painters do in oil; not giving it all the force it is to have for a finishing; that is, make the lights a little brighter, and the shades less dark, than they ought to be; because in dotting upon them, as you must do after dead-colouring, the colour is always fortified, and would at last be too dark.

There are several ways of dotting; and every painter has his own. Some make their dots perfectly round; others make them a little longish; others hatch by little strokes that cross each other every way, till the work appears as if it had been wrought with dots. This last method is the best, the boldest, and the soonest done: wherefore such as would paint in miniature ought to use it, and to inure themselves from the first to dot in the plump and the soft way; that is to say, where the dots are lost, in a manner, in the ground, upon which you work, and only so much appears as is sufficient to make the work seem dotted. The hard and the dry way is quite the reverse, and always to be avoided. This is done by dotting with a colour much darker than your ground, and when the pencil is not moistened enough with the colour, which makes the work seem rough and uneven.

Study likewise carefully to lose and drown your colours one in another, so that it may not appear where they disjoin; and to this end, soften or allay your touches with colours that partake of both, in such sort that it may not appear to be your touches which cut and disjoin them. By the word *cut*, we are to understand what manifestly separates and divides, and does not run in and blend itself with the neighbouring colours; which is rarely practised but upon the borders of drapery.

When your pieces are finished, to heighten them a little, give them a fine air; that is to say, give, upon the extremity of the lights, small touches with a colour yet lighter, which must be lost and drowned with the rest.

When the colours are dry upon your pallet or in your shells, in order to use them, they must be diluted with water. And when you perceive they want gum, which is seen when they easily rub off the hand or the vellum if you give a touch with them upon either, they must be tempered with gum-water instead of pure water, till they are in condition.

There are several sorts of grounds for pictures and portraitures. Some are wholly dark, composed of bistre, umbre, and Cologn earth, with a little black and white; others more yellow, in which is mixed a great deal of ochre; others greyer, which partake of indigo In order to paint a ground, make a wash of the colour or mixture you would have it, or according to that of the picture or portraiture you would copy; that is to say, a very light lay, in which there is hardly any thing but water, in order to soak the vellum. Then pass another lay over that, somewhat thicker, and strike it on very smoothly with large strokes as quick as you can, not touching twice in the same place before it be dry; because the second stroke carries off what

Of Working.

what has been laid on at the first, especially when you lean a little too hard upon the pencil.

Other dark grounds are likewise made of a colour a little greenish: and those are most in use, and the properest to lay under all sorts of figures and portraitures; because they make the carnation, or naked parts of a picture, appear very fine; are laid on very easily, and there is no occasion to dot them, as one is often obliged to do the others, which are rarely made smooth and even at the first; whereas in these one seldom fails of success at the first bout. To make them, you must mix black, Dutch pink, and white, all together; more or less of each colour, according as you would have them darker or lighter. You are to make one lay very light, and then a thicker, as of the first grounds. You may also make them of other colours, if you please; but these are the most common.

When you paint a holy person upon one of these grounds, and would paint a small glory round the head of your figure, you must not lay the colour too thick in that part, or you may even lay none at all, especially where this glory is to be very bright: but lay for the first time with white and a little ochre mixed together, of a sufficient thickness; and in proportion as you go from the place of the head, put a little more ochre; and to make it lose itself, and die away with the colour of the ground, hatch with a free stroke of the pencil, following the round of the glory, sometimes with the colour of which it is made, and sometimes with that of the ground, mixing a little white or ochre with the last when it paints too dark to work with: and do this till one be insensibly lost in another, and nothing can be seen to disjoin them.

To fill an entire ground with a glory, the brightest part is laid on with a little ochre and white, adding more of the first in proportion as you come nearer the edges of the picture: and when the ochre is not strong enough (for you must always paint darker and darker), add gall-stone, afterwards a little carmine, and lastly bistre. This first laying, or dead-colouring, is to be made as soft as possible; that is to say, let these shadowings lose themselves in one another without gap or intersection. Then the way is to dot upon them with the same colours, in order to drown the whole together; which is pretty tedious, and a little difficult, especially when there are clouds of glory on the ground. Their lights must be fortified in proportion as you remove from the figure, and finished as the rest, by dotting and rounding the clouds; the bright and obscure parts of which must run insensibly into one another.

For a day-sky, take ultramarine and a good deal of white, and mix them together. With this make a lay, as smooth as you can, with a large pencil and liberal strokes, as for grounds; applying it paler and paler as you descend towards the horizon; which must be done with vermilion or red lead, and with white of the same strength with that where the sky ends, or something less; making this blue lose itself in the red, which you bring down to the skirts of the earth, or tops of houses; mixing towards the end gall-stone and a good deal of white, in such a manner that the mixture be still paler than the former, without any visible intersection or parting between all these colours of the sky.

3

When there are clouds in the sky, you may spare the places where they are to be; that is to say, you need not lay on any blue there, but form them, if they are reddish, with vermilion, gall-stone, and white, with a little indigo; and if they are more upon the black, put in a good deal of the last; painting the lights of one and the other with masticot, vermilion, and white, more or less of any of these colours, according to the strength you would give them, or according to that of the original you copy; rounding the whole as you dot; for it is a difficult matter to lay them very smooth at the first painting: and if the sky is not even enough, you must dot it also.

It is at your pleasure to exempt the places of the clouds, for you may lay them upon the ground of the sky; heightening the bright parts by putting a good deal of white, and fortifying the shadows by using less. This is the shortest way.

A night or stormy sky is done with indigo, black, and white, mixed together; which is laid as for a day-sky. To this mixture must be added ochre, vermilion, or brown-red, for the clouds; the lights of which are to be of masticot, or red-lead, and a little white; now redder, now yellower, at discretion. And when it is a tempestuous sky, and lightning appears in some places, be it blue or red, it is to be done as in a day-sky, drowning and losing the whole together at the first forming or dead-colouring, and at the finishing.

Sect. IV. *Of Draperies.*

Of Draperies.

To paint a blue drapery, put ultramarine near the white upon your pallet; and mix a part of the one with the other, till it makes a fine pale, and has a body. With this mixture you must form the brightest parts; and then adding more ultramarine, form such as are darker; and go on after this manner till you come to the deepest plaits and the thickest shades, where you must lay pure ultramarine: and all this must be done as for a first-forming or dead-colouring; that is to say, laying the colour on with free strokes of the pencil, yet as smooth as you can; losing the lights in the shadows with a colour neither so pale as the light nor so dark as the shades. Then dot with the same colour as in the first-forming, but a small matter deeper; that the dots may be fairly seen. All the parts must be drowned one in another, and the plaits appear without intersection. When the ultramarine is not dark enough to make the deeper shadows, how well soever it be gummed, mix a little indigo with it to finish them. And when the extremities of the lights are not bright enough, heighten them with white and a very little ultramarine.

A drapery of carmine is done in the same manner as the blue; except that in the darkest places there is to be a lay of pure vermilion, before you dead-colour with carmine, which must be applied at top; and in the strongest shades, it must be gummed very much. To deepen it the more, mix a little bistre with it.

There is likewise made another red drapery, which is first drawn with vermilion, mixing white with it to dead-colour the bright places, laying it pure and unmixed for those that are darker, and adding carmine

mine

Of Draperies.

mine for the grand ſhades. It is finiſhed afterwards, like other draperies, with the ſame colours. And when the carmine with the vermilion do not darken enough, work with the firſt alone, but only in the deepeſt of the ſhades.

A drapery of lake is made in the ſame manner with that of carmine; mixing a good deal of white with it for the bright places, and very little for thoſe that are dark. It is finiſhed likewiſe with dotting; but you have nothing to do with vermilion in it.

Violet-draperies are likewiſe done after this manner; after making a mixture of carmine and ultramarine, putting always white for the bright parts. If you would have your violet be columbine or dove-colour, there muſt be more carmine than ultramarine: but if you would have it bluer and deeper, put more ultramarine than carmine.

A drapery is made of a fleſh-colour, beginning with a lay made of white, vermilion, and very pale lake; and making the ſhades with the ſame colours, uſing leſs white in them. This drapery muſt be very pale and tender, becauſe the ſtuff of this colour is thin and light; and even the ſhades of it ought not to be deep.

To make a yellow drapery, put a lay of maſticot over all; then one of gamboge upon that, excepting the brighteſt places, where the maſticot muſt be left entire; the dead-colour with ochre, mixed with a little gamboge and maſticot, putting more or leſs of the laſt according to the ſtrength of the ſhades. And when theſe colours do not darken enough, add gall-ſtone. And gall-ſtone pure and unmixed is uſed for the thickeſt ſhades; mixing a little biſtre with it, if there be occaſion to make them ſtill darker. You finiſh by dotting with the ſame colours you dead-coloured with, and loſing the lights and the ſhades in one another.

If you put Naples-yellow, or Dutch-pink, in lieu of maſticot and gamboge, you will make another ſort of yellow.

The green drapery is made by a general lay of verditer; with which, if you find it too blue, mix maſticot for the lights, and gamboge for the ſhades. Afterwards add to this mixture lily-green or ſap-green, to ſhadow with; and as the ſhades are thicker, put more of theſe laſt greens, and even work with them pure and unmixed where they are to be extremely dark. You finiſh with the ſame colours, a little darker.

By putting more yellow, or more blue, in theſe colours, you may make different ſorts of greens as you pleaſe.

To make a black drapery, you dead-colour with black and white, and finiſh with the ſame colour, putting more black as the ſhades are thicker; and for the darkeſt, mix indigo with it, eſpecially when you would have the drapery appear like velvet. You may always give ſome touches with a brighter colour, to heighten the lights of any drapery whatſoever.

A white woollen drapery is made by a lay of white, in which there muſt be a very ſmall matter of ochre, orpiment, or gall-ſtone, that it may look a little yellowiſh. Then dead-colour, and finiſh the ſhades with blue, a little black, white, and biſtre; putting a great deal of the laſt in the darkeſt.

The light-grey is begun with black and white, and finiſhed with the ſame colour deeper.

For a brown drapery, make a lay of biſtre, white, and a little brown-red; and ſhadow with this mixture, made a little darker.

There are other draperies, called *variable*, becauſe the lights are of a different colour from the ſhades. Theſe are moſtly uſed for the veſtments of angels, for young and gay people, for ſcarfs and other airy attire, admitting of a great many folds, and flowing at the pleaſure of the wind. The moſt common are the violets: of which they make two ſorts; one, where the lights are blue; and the other, where they are yellow.

For the firſt, put a lay of ultramarine and very pale white upon the lights; and ſhadow with carmine, ultramarine, and white, as for a drapery wholly violet; ſo that only the grand lights appear blue. Yet they muſt be dotted with violet, in which there is a great deal of white, and loſt inſenſibly in the ſhades.

The other is done by putting upon the lights only, inſtead of blue, a lay of maſticot; working the reſt as in the drapery all violet, excepting that it muſt be dotted, and the light parts blended with the ſhadowy, that is, the yellow with the violet, with a little gamboge.

The carmine-red is done like the laſt; that is, let the lights be done with maſticot, and the ſhades with carmine; and to loſe the one in the other, make uſe of gamboge.

The lake-red is done like that of carmine.

The green is done as the lake; always mixing verditer with lily or ſap-green, to make the ſhades; which are not very dark.

Several other ſorts of draperies may be made at diſcretion, always taking care to preſerve the union of the colours, not only in one ſort of cloth or ſo, but alſo in a group of ſeveral figures; avoiding, as much as the ſubject will allow, the putting of blue near the colour of fire, of green againſt black; and ſo of other colours which cut and disjoin, and whoſe union is not kind enough.

Several other draperies are made of foul colours, as brown-red, biſtre, indigo, &c. and all in the ſame manner. Likewiſe of other colours, ſimple and compound; the agreement between which is always to be minded, that the mixture may produce nothing harſh and diſagreeable to the eye. No certain rule can be laid down for this. The force and effect of your colours are only to be known from uſe and experience, and you muſt work according to that knowledge.

Linen cloths are done thus: After drawing the plaits or folds, as is done in a drapery, put a lay of white over all; then dead-colour, and finiſh the ſhades with a mixture of ultramarine, black, and white, uſing more or leſs of the laſt, according to their ſtrength or tenderneſs; and in the greateſt deepenings put biſtre, mixed with a little white; giving only ſome touches of this mixture, and even of pure biſtre, upon the extremities of the greateſt ſhadows, where the folds muſt be drawn, and loſt with the reſt.

They may be done in another manner, by making a general lay of this mixture of ultramarine, black, and

Of Draperies.

and very pale white; and dead-colour (as has been faid before) with the fame colour, but a little deeper. And when the fhades are dotted and finifhed, heighten the lights with pure white, and lofe them with the deepenings of the linen. But of whatever fort you make them, when they are finifhed, you muft give a yellowifh teint of orpiment and white to certain places; laying it lightly on, and as it were in water; fo that what is underneath may, notwithftanding, plainly appear, as well the fhadows as the dotting.

Yellow linen-cloth is done by putting a lay of white, mixed with a little ochre. Then form and finifh the fhades with biftre, mixed with white and ochre; and in the thickeft fhades ufe pure biftre: and before you finifh, give fome teints here and there of ochre and white, and others of white and ultramarine, as well upon the fhades as the lights; but let them be very bright: and drown the whole together in dotting, and it will look finely. As you finifh, heighten the extremities of the lights with mafticot and white. You may add to this fort of linen, as well as to the white, certain bars from fpace to fpace, as in Turkey-mantuas; that is, fmall ftripes blue and red with ultramarine and carmine; one of red between two of blue, very bright and clear upon the lights, and deeper upon the fhades. Virgins are pretty often dreffed with veils of this fort (by Popifh painters), and fcarfs of this kind are put about necks that are bare; becaufe they become the teint mighty well.

If you would have both thefe forts of linen tranfparent, and the ftuff or other thing that is beneath appear through them, make the firft lay for them very light and clear, and mix in the colour to fhadow with, a little of that which is underneath, efpecially towards the end of the fhades; and only do the extremities of the lights, for the yellow, with mafticot and white; and for the white, with pure white.

They may be done in another manner, efpecially when you would have them altogether as clear as muflin, lawn, or gauze. To this end form and finifh what is to be beneath, as if nothing was to be put over it. Then mark out the light and clear folds with white or mafticot; and a fhadowy with biftre and white, or with black, blue, and white, according to the colour you would make them of; making the reft fomewhat fainter: yet this is not neceffary but for the parts that are not to be fo clear.

Crape is done the fame way; excepting that the folds of the fhades and the lights, and the borders too, are to be marked out with little filaments of black upon what is underneath; which is likewife to be finifhed beforehand.

When you would make a ftuff like a watered tabby, make the waves upon it with a colour a little lighter, or a little darker, in the lights and the fhades.

There is a manner of touching draperies which diftinguifhes the filken from the woollen. The laft are more terreftrial and fenfible; the others more light and fading. But it muft be obferved, that this is an effect which depends partly upon the ftuff and partly upon the colour; and for the employing thefe in a manner fuitable to the fubjects and the deepenings of painting, we fhall here touch upon their different qualities.

We have no colour which partakes more of light, nor which comes nearer the air, than white; which fhows it to be fickle and fleeting. It may, neverthelefs, be held and brought to by fome neighbouring colour, more heavy and fenfible, or by mixing them together.

Blue is a moft fleeting colour: and fo we fee, that the fky and the remoteft views of a picture are of this colour; but it will become lighter and fickler in proportion as it is mixed with white.

Pure black is the heavieft and moft terreftrial of all colours; and the more of it you mix with others, the nearer you bring them to the eye.

Neverthelefs, the different difpofitions of black and white make alfo their effects different: for white often makes black difappear, and black brings white more into view; as in the reflection of globes, or other figures to be made round, where there are always parts that fly as it were from the eye, and deceive it by the craft of art: and under the white are here comprehended all the light colours; as under the black, all the heavy colours.

Ultramarine is, then, foft and light.

Ochre is not fo much fo.

Mafticot is very light; and fo is verditer.

Vermilion and carmine come near this quality.

Orpiment and gamboge not fo near.

Lake holds a certain mean, rather foft than rough.

Dutch pink is an indifferent colour, eafily taking the quality of others. So it is made terreftrial by mixing it with colours that are fo; and, on the contrary, the moft light and fleeting by joining it with white or blue.

Brown red, umber, dark greens, and biftre, are the heavieft and moft terreftrial, next to black.

Skilful painters, who underftand perfpective, and the harmony of colours, always obferve to place the dark and fenfible colours on the fore-parts of their pictures; and the moft light and fleeting they ufe for the diftances and remote views. And as for the union of colours, the different mixtures that may be made of them will learn you the friendfhip or antipathy they have to one another. And upon this you muft take your meafures for placing them with fuch agreement as fhall pleafe the eye.

For the doing of lace, French-points, or other things of that nature, put over all a lay of blue, black, and white, as for linen: then heighten the flower-work with pure white: afterwards make the fhades above with the firft colour, and finifh them with the fame. When they are upon the carnation or naked parts of a picture, or upon any thing elfe that you would fhow through another, finifh what is beneath, as if nothing was to be put over it: and at top, make the points or lace with pure white, fhadowing and finifhing them with the other mixture.

If you would paint a fur, you muft begin with a kind of drapery, done, if it be dark, with biftre and white, making the fhadowings of the fame colour, with lefs white. If the fur be white, do it with blue, white, and a little biftre. And when this beginning, or firft-forming, is done, inftead of dotting, draw fmall ftrokes, turning, now in one manner, now in another, according to the courfe and flatting of the hair. Heighten the lights of dark furs with ochre and white, and of the other with white and a little blue.

For

Of Carnations. For doing a building, if it be of ftone, take indigo, biftre, and white, with which make the beginning or firft form of it; and for fhadowing it, put lefs of this laft; and more biftre than indigo, according to the colour of the ftone you would paint. To thefe you may likewife add a little ochre, both for the forming and the finifhing. But to make it finer, you muft give, here and there, efpecially for old fabrics, blue and yellow teints, fome with ochre, others with ultramarine, mixing always white with them, whether before the firft-forming, provided they appear through the draught, or whether upon it, lofing or drowning them with the reft when you finifh.

When the building is of wood, as there are many forts, it is done at difcretion; but the moft ordinary way is to begin or firft-form with ochre, biftre, and white, and finifh without white, or with very little; and if the fhades are deep, with pure biftre. In the other they add fometimes vermilion, fometimes green or black; in a word, juft according to the colour they would give it; and they finifh with dotting, as in draperies and every thing elfe.

Sect. V. *Of Carnations, or the naked parts of Painting.*

There are in carnation fo many different colourings, that it would be a difficult thing to give general rules upon fo variable a fubject. Nor are they minded, when one has got, by cuftom and practice, fome habit of working eafily: and fuch as are arrived to this degree, employ themfelves in copying their originals, or elfe they work upon their ideas, without knowing how: infomuch, that the moft fkilful, who do it with lefs reflection and pains than others, would likewife be more put to it to give an account of their maxims and knowledge in the matter of painting, if they were to be afked what colours they made ufe of for fuch and fuch a colouring, a teint here, and another there.

Neverthelefs, as beginners want fome inftruction at the firft, we will fhow in general after what manner feveral carnations are to be done.

In the firft place, after having drawn your figure with carmine, and ordered your piece, apply, for women and children, and generally for all tender colourings, a lay of white, mixed with a very little of the blue made for faces, of which we have told the compofition; but let it hardly be feen.

And for men, inftead of blue, they put in this firft lay a little vermilion; and when they are old, a little ochre is mixed with it.

Afterwards follow all the traces with vermilion, carmine, and white, mixed together; and begin all the fhades with this mixture, adding white in proportion as they are weaker; and putting but little in the darkeft, and none, in a manner, in certain places where ftrong touches are to be given: for inftance, in the corner of the eye; under the nofe; at the ears; under the chin; in the feparations of the fingers; in all joints; at the corners of the nails; and generally in every part where you would mark out feparations in fhades that are obfcure. Neither need you fear to give to thofe places all the force and ftrength they ought to have as foon as you begin or firft-form them, becaufe in working at top with green, the red you have put there is always weakened.

After having begun, or firft-formed, or dead-coloured, with red, make blue teints with ultramarine and a great deal of white, upon the parts which fly from the eye; that is to fay, upon the temples; under and in the corners of the eyes; on both fides the mouth, above and below; a little upon the middle of the forehead; between the nofe and the eyes; on the fide of the cheeks; on the neck and other places where the flefh affumes a bluifh caft. Yellowifh teints are likewife made with ochre or orpiment, and a little vermilion mixed with white, under the eye-brows, on the fides of the nofe towards the bottom, a little underneath the cheeks, and upon the other parts which rife and come nearer the eye. It is efpecially from thefe teints that the natural complexion is to be obferved, in order to catch it; for painting being an imitation of nature, the perfection of the art confifts in the juftnefs and fimplicity of the reprefentation, efpecially in face-painting.

When, therefore, you have done your firft lay, your dead colouring, and your teints, you muft work upon the fhades, dotting with green for the carnations or naked parts, mixing, according to the rule we have given for the teints, a little blue for the parts which fly from the eye; and, on the other hand, making it a little yellower for thofe that are more fenfible; that is to fay, which rife, and come nearer the eye: and at the end of the fhades, on the fide of the light, you muft blend and lofe your colour infenfibly in the ground of the carnation with blue, and then with red, according to the places where you paint. If this mixture of green does not work dark enough at firft, pafs over the fhades feveral times, now with red, and now with green; always dotting: and this do till they are as they fhould be.

And if you cannot with thefe colours give the fhades all the force they ought to have, finifh, in the darkeft, with biftre mixed with orpiment, ochre, or vermilion, and fometimes with pure biftre, according to the colouring you would make, but lightly, laying on your colour very clear.

You muft dot upon the clear and bright places with a little vermilion or carmine, mixed with much white, and a very fmall matter of ochre, in order to lofe them with the fhadowy, and to make the teints die away infenfibly into one another; taking care, as you dot, or hatch, to make your ftrokes follow the turnings and windings of the flefhy parts. For though the rule be to crofs always, this dotting or hatching ought to appear a little more here, becaufe it rounds the parts. And as this mixture might make a colouring too red, if it was always to be ufed, they work likewife in every part, to blend the teints and the fhades, with blue and a little green, and much white, fo mixed as to be very pale; excepting, neverthelefs, that this colour muft not be put upon the cheeks, nor upon the extremities of the clear parts, no more than the other mixture upon thefe laft, which muft be left with all their light; as certain places of the chin, of the nofe, and of the forehead, and upon the cheeks; which, and the cheeks, ought neverthelefs to be redder than the reft, as well as the feet, the hollows of the hands, and the fingers of both.

Obferve,

Of Carnations.

Obferve, that thefe two laft mixtures ought to be fo pale, that the work fhall hardly be vifible; for they ferve only to foften it; to unite the teints with one another, and the fhades with the lights, and to drown the traces. Care muft likewife be taken that you work not too much with the red mixture upon the blue teints, nor with the blue upon the others; but change the colour from time to time, when you perceive it works too blue or too red, till the work be finifhed.

The white of the eyes muft be fhadowed with this fame blue, and a little flefh-colour; and the corners, on the fide of the nofe, with vermilion and white; giving them a little touch of carmine. The whole is foftened with this mixture of vermilion, carmine, white, and a very fmall matter of ochre.

The apples or balls of the eyes are done with the mixture of ultramarine and white; the laft prevailing a little; adding a little biftre, if they are yellowifh; or a little black, if they are grey. Make the little black circle in the middle, called the *cryftal of the eye;* and fhadow the balls with indigo, biftre, or black, according to the colour they are of; giving to each a fmall touch of pure vermilion round the cryftal; which muft be loft with the reft at the finifhing. This gives vivacity to the eye.

The round or circumference of the eye is done with biftre and carmine; that is to fay, the flits or partings, and the eye-lids, when they are large and bold; efpecially the upper ones; which muft afterwards be foftened with the red or blue mixtures we have mentioned before, to the end they may be loft in one another, and nothing feem interfected. When this is done, give a little touch of pure white upon the cryftal, on the fide of the lights. This makes the eye fhine, and gives life to it.

The mouth is dead-coloured with vermilion, mixed with white; and finifhed with carmine, which is foftened as the reft. And when the carmine does not work dark enough, mix a little biftre with it. This is to be underftood of the corners in the feparation in the lips; and particularly, of certain mouths half open.

The hands, and all the other parts of carnation, are done in the fame manner as the faces; obferving, that the ends of the fingers be a little redder than the reft. When your whole work is formed and dotted, mark the feparations of all the parts with little touches of carmine and orpiment mixed together, as well in the fhadowy as the light places; but a little deeper and ftronger in the firft, and lofe them in the reft of the carnation.

The eye-brows and the beard are dead-coloured, as are the fhades of carnations; and finifhed with biftre, ochre, or black, according to the colour they are of, drawing them by little ftrokes the way they ought to go; that is to fay, give them all the nature of hair. The lights of them muft be heightened with ochre and biftre, a little vermilion, and much white.

For the hair of the head, make a lay of biftre, ochre, and white, and a little vermilion. When it is very dark-coloured, ufe black inftead of ochre. Afterwards form the fhadowy parts with the fame colours, putting lefs white in them; and finifh with pure biftre, or mixed with ochre or black, by fmall ftrokes very fine, and clofe to each other, waving and buckling them according to the curling of the hair. The light parts muft alfo be heightened by little ftrokes with ochre or orpiment, white, and a little vermilion. After which, lofe the lights and the fhades in each other, by working fometimes with a dark and fometimes with a light colour.

Of Carnations.

And for the hair about the forehead, through which the fkin is feen, it muft be firft formed with the colour thereof, and that of the carnation, working and fhadowing with one and the other, as if you defigned to paint none. Then form it, and finifh with biftre. The lights are to be heightened as the other. Grey hair is dead-coloured with white, black, and biftre, and finifhed with the fame colour, but deeper; heightening the bright and clear parts of the hair, as well as thofe of the eye brows and the beard, with white and very pale blue, after having formed them as the others, with the colour of the flefh or fkin; and finifh with biftre.

But the moft important thing is to foften one's work; to blend the teints in one another, as well as the beard and the hair about the forehead, with the other hair and the carnation; taking efpecial care not to work rough and dry; and that the traces, turnings, and windings of the carnation, or naked parts, be not interfected. You muft likewife accuftom yourfelf to put white in your colours only in proportion as you work lighter or darker: for the colour you ufe the fecond time muft be always a little ftronger and deeper than the firft, unlefs it be for foftening.

Different colourings are eafily made, by putting more or lefs of red, or blue, or yellow, or biftre, whether for the dead-colouring, or for the finifhing.— That for women ought to be bluifh; that for children a little red; and both frefh and florid. That for men ought to be yellower; efpecially when they are old.

To make a colouring of death, there muft be a firft lay of white and orpiment, or a very pale ochre: dead-colour with vermilion, and lake, inftead of carmine, and a good deal of white; and afterwards work over it with a green mixture, in which there is more blue than any other colour, to the end the flefh may be livid and of a purple colour. The teints are done the fame way as in another colouring; but there muft be a great many more blue than yellow ones, efpecially upon the parts which fly from the fight, and about the eyes; and the laft are only to be upon the parts which rife and come nearer the eye. They are made to die away in one another, according to the ordinary manner; fometimes with very pale blue, and fometimes with ochre and white, and a little vermilion; foftening the whole together. The parts and contours muft be rounded with the fame colours. The mouth is to be, in a manner, of a quite violet. It is dead-coloured, however, with a little vermilion, ochre, and white; but finifhed with lake and blue: and to give it the deep ftrokes, they take biftre and lake; with which they likewife do the fame to the eyes, the nofe, and the ears. If it is a crucifix, or fome martyr, upon whom blood is to be feen, after the finifhing the carnation, form it with vermilion, and finifh it with carmine, making in the drops of blood a little bright reflecting fpark, to round them. For the crown of thorns, make a lay of fea-green and mafticot;

Of Ornations.

shadow it with biftre and green; and heighten the clear and light parts with mafticot.

Iron is formed, or firft laid, with indigo, a little black and white; and finifhed with pure indigo, heightening it with white.

For painting fire and flames, the lights are done with mafticot and orpiment; and for the fhades, they mix vermilion and carmine.

A fmoke is done with black, indigo, and white, and fometimes with biftre; one may likewife add vermilion or ochre, according to the colour it is to be of.

Pearls are painted by putting a lay of white, and a little blue: they are fhadowed and rounded with the fame colour, deeper; a fmall white dot is made almoft in the middle, on the fide of the light; and on the other fide, between the fhadow and the edge of the pearl, they give a touch with mafticot, to make the reflection; and under the pearls is made a little fhadow of the colour of the ground they are upon.

Diamonds are made with pure black; then they heighten them with little touches of white on the fide of the light. It is the fame thing for any other jewels you have a mind to paint: there is nothing to be done but to change the colour.

For making a figure of gold, put a lay of fhell-gold, and fhadow it with gall-ftone. Silver is done the fame way; excepting that it muft be fhadowed with indigo.

One great means to acquire a perfection in the art, is to copy excellent originals. We enjoy with pleafure and tranquillity the labour and pains of others. But a man muft copy a great number before he is able to produce as fine effects: and it is better to be a good copier than a bad author.

Sect. VI. *Of Landfcapes.*

In the firft place, after having ordered the economy of your landfcape as of your other pieces, you muft form the neareft grounds or lands, when they are to appear dark, with fap or lily-green, biftre, and a little verditer, to give a body to your colour; then dot with this mixture, but a little darker, adding fometimes a little black to it.

For fuch pieces of ground as the light falls upon, and which are therefore clear and bright, make a lay of ochre and white: then fhadow and finifh with biftre. In fome they mix a little green, particularly for fhadowing and finifhing.

There are fometimes upon the fore-part certain reddifh lands; which are dead-coloured with brown-red, white, and a little green; and finifhed with the fame, putting a little more green in them.

For the making of grafs and leaves upon the fore-ground, you muft, when that is finifhed, form with fea-green, or verditer, and a little white; and for thofe that are yellowifh, mix mafticot. Afterwards fhadow them with lily-green, or biftre and gall-ftone, if you would have them appear withered.

The grounds or lands at a little diftance are formed with verditer, and fhadowed and finifhed with fap-green, adding biftre for fome of the touches here and there.

Such as are at a greater diftance, are done with fea-green and a little blue; and fhadowed with verditer.

Of Landfcapes.

In a word, the farther they go, the more bluifh they are to be made; and the fartheft diftances ought to be of ultramarine and white; mixing in fome places fmall touches of vermilion.

Water is painted with indigo and white, and fhadowed with the fame colour, but deeper; and to finifh it, inftead of dotting, they do nothing but make ftrokes and traces without croffing; giving them the fame turn with the waves, when there are any. Sometimes a little green muft be mixed in certain places, and the light and clear parts heightened with pure white, particularly where the water foams.

Rocks are dead-coloured like buildings of ftone; excepting that a little green is mixed for forming and fhadowing them. Blue and yellow teints are made upon them, and loft with the reft in finifhing. And when there are fmall branches, with leaves, mofs, or grafs, when all is finifhed, they are to be raifed at top with green and mafticot. They may be made yellow, green, and reddifh, for appearing dry, in the fame manner as on the ground. Rocks are dotted as the reft; and the farther they are off, the more greyifh they are made.

Caftles, old houfes, and other buildings of ftone and wood, are done in the manner abovementioned; fpeaking of thofe things, when they are upon the firft lines. But when you would have them appear at a diftance, you muft mix brown-red and vermilion, with much white; and fhadow very tenderly with this mixture; and the farther they are off, the weaker are the ftrokes to be for the feparations. If they are covered with flate, it is to be made bluer than the reft.

Trees are not done till the fky be finifhed; one may, neverthelefs, fpare the places of them when they contain a good number; and however it be, fuch as come near the eye, are to be dead-coloured with verditer, mixing fometimes ochre; and fhadowed with the fame colours, adding lily-green. Afterwards you muft work leaves upon them by dotting without croffing: for this muft be done with fmall longifh dots, of a darker colour, and pretty full of it, which muft be conducted on the fide the branches go, by little tufts of a little darker colour. Then heighten the lights with verditer or fea-green, and mafticot, making leaves in the fame manner: and when there are dry branches or leaves, they are dead-coloured with brown-red or gall-ftone, with white; and finifhed with gall-ftone, without white, or with biftre.

The trunks of trees are to be dead-coloured with ochre, white, and a little green, for the light and clear parts; and for the dark, they mix black, adding biftre and green for fhadowing one and the other. Blue and yellow teints are likewife made upon them, and little touches given here and there with white and mafticot; fuch as you ordinarily fee upon the bark of trees.

The branches which appear among the leaves are done with ochre, verditer, and white; or with biftre and white, according to the light they are placed in. They muft be fhadowed with biftre and lily-green.

Trees, which are at a little diftance, are dead-coloured with verditer and fea-green; and are fhadowed

and

Of Landscape.

and finished with the same colours, mixed with lily-green. When there are some which appear yellowish, lay with ochre and white, and finish with gall-stone.

For such as are in the distances and remote views, you must dead colour with sea-green; with which, for finishing, you must mix ultramarine. Heighten the lights of one and the other with masticot, by small disjoined leaves.

It is the most difficult part of landscape, in manner of miniature, to leaf a tree well. To learn, and break one's hand to it a little, the way is to copy good ones; for the manner of touching them is singular, and cannot be acquired but by working upon trees themselves; about which you must observe to make little boughs, which must be leafed, especially such as are below and toward the sky.

And generally, let your landscapes be coloured in a handsome manner, and full of nature and truth; for it is that which gives them all their beauty.

SECT. VII. *Of Flowers.*

It is an agreeable thing to paint flowers, not only on account of the splendour of their different colours, but also by reason of the little time and pains that are bestowed in trimming them. There is nothing but delight in it; and, in a manner, no application. You maim and bungle a face, if you make one eye higher than another; a small nose with a large mouth; and so of other parts. But the fears of these disproportions constrain not the mind at all in flower-painting; for unless they be very remarkable, they spoil nothing. For this reason most persons of quality, who divert themselves with painting, keep to flowers. Nevertheless, you must apply yourself to copy justly: and for this part of miniature, as for the rest, we refer you to nature, for she is your best model. Work, then, after natural flowers; and look for the teints and different colours of them upon your pallet: a little use will make you find them easily; and to facilitate this to you at the first, we shall, in the continuance of our design, show the manner of painting some; for natural flowers are not always to be had; and one is often obliged to work after prints, where nothing is seen but graving.

It is a general rule, that flowers are designed and laid like other figures; but the manner of forming and finishing them is different: for they are first formed only by large strokes and traces, which you must turn at the first the way the small ones are to go, with which you finish; this turning aiding much thereto. And for finishing them, instead of hatching or dotting, you draw small strokes very fine, and very close to one another, without crossing; repassing several times, till your dark and your clear parts have all the force you would give them.

Of Roses.—After making your first sketch, draw with carmine the red rose, and apply a very pale lay of carmine and white. Then form the shades with the same colour, putting less white in it: and lastly, with pure carmine, but very bright and clear at the first; fortifying it more and more as you proceed in your work, and according to the darkness of the shades. This is done by large strokes. Then finish; working upon it with the same colour by little strokes, which you must make go the same way with those of the graving, if it be a print you copy; or the way the leaves of the rose turn, if you copy after a painting, or after nature; losing the dark in the clear parts, and heightening the greatest lights, and the brightest or most lightsome leaves, with white and a little carmine. You must always make the hearts of roses, and the side of the shadow darker than the rest; and mix a little indigo for shadowing the first leaves, particularly when the roses are blown, to make them seem faded. The seed is dead-coloured with gamboge; with which a little sap-green is mixed for shadowing. Roses streaked with several colours, ought to be paler than others, that the mixture of colours may be better seen; which are done with carmine; a little darker in the shades, and very clear in the lights; always hatching by strokes. For white roses you must put a lay of white, and form and finish them as the red; but with black, white, and a little bistre; and make the seed a little yellower. Yellow roses are done by putting in every part a lay of masticot, and shadowing them with gamboge, gall-stone, and bistre; heightening the clear and light places with masticot and white.

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The stiles, the leaves, and the buds of all sorts of roses are formed with verditer, with which is mixed a little masticot and gamboge; and for shadowing them, they add sap-green, putting less of the other colours when the shades are deep. The outside of the leaves ought to be bluer than the inside: wherefore it must be dead-coloured with sea-green, and sap-green mixed with that for shadowing, making the veins or fibres on this side clearer than the ground, and those on the other side darker. The prickles which are upon the stiles and buds of roses, are done with little touches of carmine, which are made to go every way; and for those that are upon the stalks, they are formed with verditer and carmine, and shadowed with carmine and bistre: making the bottom of the stalks more reddish than the top: *i. e.* you must mix with the green, carmine and pure bistre.

Of Tulips.—As there is an infinity of tulips, different from one another, one cannot pretend to mention the colours with which they are all done. We will only touch upon the handsomest, called *streaked*; and these streaks are dead-coloured with very clear carmine in some places, and with darker in others; finishing with the same colour by little strokes, which must be carried the same way with the streaks. And in others is put first a lay of vermilion. Then they form them by mixing carmine, and finish them with pure carmine. In some they put Florence-lake over the vermilion instead of carmine. Some are done with lake and carmine mixed together, and with lake alone, or with white and lake for the first forming; whether it be rose-pink or Florence-lake. There are some of a purple colour, which are formed with ultramarine, carmine, or lake, sometimes bluer and sometimes redder. The manner of doing both one and the other is the same: there is no difference but in the colours. You must, in certain places, as between the streaks of vermilion, carmine, or lake, sometimes put blue made of ultramarine and white, and sometimes a very bright purple, which is finished by strokes as the rest, and lost with the streaks. There are some likewise

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likewise that have fallow teints, that are made with lake, bistre, and ochre, according as they are: but this is only in fine and rare tulips, and not in the common ones. For shadowing the bottom of them, they ordinarily take indigo and white for such whose streaks are of carmine. For such as are of lake, they take black and white; with which, in some, bistre is mixed, and in others green. Some are likewise to be shadowed with gamboge and umber, and always by strokes and traces, that turn as the leaves turn. Other tulips are likewise done, called *bordered;* that is to say, the tulip is not streaked but on the edges of the leaves, where there is a border. It is white in the purple; red in the yellow; yellow in the red; and red in the white. The purple is laid with ultramarine, carmine, and white; shadowing and finishing it with this mixture. The border is spared; that is to say, let only a light lay of white be put there, and let it be shadowed with very bright indigo. The yellow is formed with gamboge, and shadowed with the same colour, mixing ochre and umber or bistre with it. The border is laid with vermilion, and finished with a very small matter of carmine. The red is formed with vermilion, and finished with the same colour, mixing carmine or lake with it. The bottom and the border are done with gamboge; and for finishing, they add gall-stone and umber, or bistre. The white is shadowed with black, blue, and white. Indian ink is very proper for this. The shadowings of it are very tender. It produces alone the effect of blue and white, mixed with the other black. The border of this white tulip is done with carmine. In all these sorts of tulips, they leave a nerve or sinew in the middle of the leaves that are brighter than the rest: and the borders are drowned at the bottom by small traces, turning crosswise; for they must not appear cut and separated, as the streaked or party-coloured. They make them likewise of several other colours. When they happen to be such whose bottoms on the inside are black, as it were, they form and finish them with indigo, as also the seed about the nozzle or stalk. And if the bottom is yellow, it is formed with gamboge, and finished by adding umbre or bistre. The leaves and the stalks of tulips are ordinarily formed with sea-green, and shadowed and finished with lily-green, by large traces all along the leaves. Some may likewise be done with verditer, mixing masticot with it, and shadowed with sap-green, that the green of the shades may be yellower.

The Anemony, or *Wind-flower.*—There are several sorts of them, as well double as single. The last are ordinarily without streaks. Some are made of a purple colour, with purple and white, shadowing them with the same colour; some redder, others bluer; sometimes very pale, and sometimes very dark. Others are formed with lake and white, and finished with the same, putting less white; some without any white at all. Others are formed with vermilion, and shadowed with the same colour, adding carmine. We see likewise white ones, and some of a citron colour. The last are laid with masticot; and one and the other shadowed and finished sometimes with vermilion, and sometimes with very brown lake, especially near the seed, at the bottom; which is often likewise of a blackish colour, that is done with indigo, or black and blue, mixing for some a little bistre; and always working by very fine strokes and traces, and losing the lights in the shades. There are others that are brighter and clearer at the bottom than any where else; and sometimes they are perfectly white there, though the rest of the flower be dark. The seed of all these anemonies is done with indigo and black, with a very little white, and shadowed with indigo; and in some it is raised with masticot. The double anemonies are of several colours. The handsomest have their large leaves streaked. Some are done, that is, the streaked or party-coloured, with vermilion, to which carmine is added for the finishing; shadowing the rest of the leaves with indigo; and for the small leaves within, a lay is put of vermilion and white, and they are shadowed with vermilion mixed with carmine, mixing here and there some stronger touches, especially in the heart of the flower, next the great leaves on the side of the shadow. They finish with carmine, by little strokes and traces, turning the same way with the mixed or party-colours, and the leaves. They form and finish the streaks or party-colours of some others, as well as the small leaves, with pure carmine; leaving, nevertheless, in the middle of the last, a little circle, in which is laid dark purple, which is lost with the rest. And when all is finished, they give some touches with this same colour round about the small leaves, especially on the side of the shadow; drowning them with the large ones, the remainder of which is shadowed either with indigo or black. In some, the small leaves are done with lake or purple, though the party-colours of the large ones be done with carmine. There are others, whose mixed colours are done with carmine, in the middle of most of the large leaves; putting in some places vermilion underneath, and losing these colours with the shadows of the bottom; which are done with indigo and white. The small leaves are laid with masticot, and shadowed with very dark carmine on the side of the shade, and with very clear on the side of the light, leaving there in a manner pure masticot, and giving only some little touches with orpiment and carmine, to separate the leaves, which may be shadowed sometimes with a very little pale-green. There are double anemonies painted all red, and all purple. The first are formed with vermilion and carmine, in a manner without white, and shadowed with pure carmine, well gummed, that they may be very dark. Purple anemonies are laid with purple and white, and finished with white. In a word, there are double anemonies as there are single ones, of all colours; and they are done in the same manner. The green of one and the other is verditer; with which masticot is mixed for forming. It is shadowed and finished with sap green. The stiles of them are a little reddish; wherefore they are shadowed with carmine mixed with bistre, and sometimes with green, after having laid them with masticot.

The Carnation and the Pink.—It is with pinks and carnations as with anemonies and tulips; that is, there are some mixt-coloured, and others of one single colour. The first are streaked and diversified sometimes with vermilion and carmine; sometimes with pure lake, or with white; some streaks very dark, and others very pale; sometimes by little streaks and diversifications, and sometimes by large ones. Their bottoms

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bottoms are ordinarily ſhadowed with indigo and white. There are pinks of a very pale fleſh-colour, and ſtreaked and diverſified with another, a little deeper, made with vermilion and lake. Others, which are of lake and white, are ſhadowed and ſtreaked without white. Others all red, which are done with vermilion and carmine as dark as poſſible. Others all of lake. And, laſtly, there are others, wherein nature or fancy is the rule. The green of one and the other is ſea-green, ſhadowed with lily-green or ſap-green.

The Red-lily.—It is laid with red-lead, formed with vermilion, and in the deepeſt of the ſhades with carmine; and finiſhed with the ſame colour by ſtrokes and traces, turning as the leaves turn. The clear and light parts are heightened with red-lead and white. The ſeed is done with vermilion and carmine. The green parts are done with verditer, ſhadowed with lily or ſap-green.

The Day-lily.—There are three ſorts of them:

1. The gridelin, a little red;
2. The gridelin, very pale; and,
3. The white.

For the firſt they put a lay of lake and white, and ſhadow and finiſh with the ſame colour deeper; mixing a little black to deaden it, eſpecially in the darkeſt places.

The ſecond are laid with white, mixed with a very little lake and vermilion, in ſuch a manner that theſe two laſt colours are hardly ſeen. Afterwards they ſhadow with black and a little lake, working redder in the middle of the leaves, next the ſtalks; which ought to be, as alſo the ſeed, of the ſame colour, particularly towards the top; and at the bottom a little greener.

The ſtile of the ſeed is laid with maſticot, and ſhadowed with ſap-green.

The other day-lilies are done by putting a lay of pure white, and ſhadowing and finiſhing with black and white.

The ſtalks of theſe laſt, and the greens of them all, are done with ſea-green, and ſhadowed with ſap-green.

The Hyacinth, or *Purple-flower*.—There are four ſorts of them:

The blue, a little dark;
Others paler;
The gridelin;
And the white.

The firſt are laid with ultramarine and white; and ſhadowed and finiſhed with leſs white. Others are laid and ſhadowed with pale blue. The gridelines are formed with lake and white, and a very ſmall matter of ultramarine; and finiſhed with the ſame colour a little deeper. For the laſt they put a lay of white; then they ſhadow them with black, with a little white; and finiſh them all by ſtrokes and traces, following the turnings and windings of the leaves. The green and the ſtalks of ſuch as are blue, are done with ſea and lily-green very dark: and in the ſtalks of the firſt may be mixed a little carmine, to make them reddiſh. The ſtalks of the two others, as alſo the green, are formed with verditer and maſticot, and ſhadowed with ſap-green.

The Piony.—A lay of Venice-lake and white muſt be put on all parts, pretty ſtrong: then ſhadow with leſs white, and with none at all in the darkeſt places: after which finiſh with the ſame colour by traces, turning them as for the roſe; gumming it very much in the deepeſt of the ſhades; and raiſing the lights and the edges of the moſt lightſome leaves with white and a little lake. Little veins are likewiſe made, which go like the ſtrokes in hatching, but are more viſible. The green of this flower is done with ſea-green, and ſhadowed with ſap-green.

Cowslips.—They are of four or five colours. There are ſome of a very pale purple

The gridelin. The white and the yellow.

The purple is done with ultramarine, carmine, and white; putting leſs white for ſhadowing. The gridelin is laid with Venice-lake, and a very ſmall matter of ultramarine, with much white; and ſhadowed with the ſame colour deeper. For the white, a lay of white muſt be put; and they muſt be ſhadowed with black and white; and finiſhed, as the others, by traces or ſtrokes. The heart of theſe cowſlips is done with maſticot in the ſhape of a ſtar, which is ſhadowed with gamboge, making a little circle in the middle with ſap-green. The yellow are laid with maſticot, and ſhadowed with gamboge and umber. The ſtiles, the leaves, and the buds, are formed with verditer, mixed with a little maſticot, and finiſhed with ſap-green; making the fibres or veins, which appear upon the leaves, with this ſame colour; and heightening the lights of the largeſt with maſticot.

The Ranunculus, or *Crow-foot*.—There are ſeveral ſorts of them: the fineſt are the orange-coloured. For the firſt, they put a lay of vermilion, with a very ſmall matter of gamboge; and add carmine for ſhadowing; finiſhing it with this laſt colour, and a little gall-ſtone. In the others may be put Venice-lake inſtead of carmine, eſpecially in the heart of the flower. The orange-coloured are laid with gamboge, and finiſhed with gall-ſtone, vermilion, and a little carmine; leaving ſome little yellow ſtreaks. The green of the ſtalks is done with verditer and very pale maſticot; mixing lily-green to ſhadow them. That of the leaves is a little darker.

The Crocus.—Theſe are of two colours:

Yellow and purple. The yellow are formed with maſticot and gall-ſtone, and ſhadowed with gamboge and gall-ſtone: after which, upon each leaf, on the outſide, are made three ſtreaks, ſeparate from one another, with biſtre and pure lake; which are loſt, by little traces, in the bottom. The outſide of the leaves is left all yellow.—The purple is laid with carmine, mixed with a little ultramarine, and very pale white. They are formed and finiſhed with leſs white; making likewiſe, in ſome, purple ſtripes or ſtreaks, very dark, as in the yellow; and in others only ſmall veins. The ſeed of both is yellow; and is done with orpiment and gall-ſtone. For the ſtiles, they put a lay of white, and ſhadow with black, mixed with a little green. The green of this flower is formed with very pale verditer, and ſhadowed with ſap-green.

The Iris.—The Perſian iris is done by putting, for the inſide-leaves, a lay of white, and ſhadowing them with indigo and green together, leaving a little white ſeparation in the middle of each leaf; and for thoſe

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those on the outside, they put in the same place a lay of masticot, which is shadowed with gall-stone and orpiment; making little dark and longish dots over all the leaf, at a small distance from one another. And at the end of each are made large strains, with bistre and lake in some, and in others with pure indigo, but very black. The rest, and the outside of the leaves, are shadowed with black. The green is formed with sea-green, and very pale masticot, and shadowed with sap-green. The Susian iris is laid with purple and white, putting a little more carmine than ultramarine; and for the shades, especially in the middle leaves, they put less white; and, on the contrary, more ultramarine than carmine; making the veins of this very colour, and leaving in the middle of the inside leaves a little yellow sinew. There are others which have this very sinew in the first leaves; the end of which only is bluer than the rest. Others are shadowed and finished with the same purple, redder: They have also the middle sinew on the outside leaves; but white and shadowed with indigo. There are likewise yellow ones; which are done by putting a lay of masticot and orpiment; shadowing them with gall-stone, and making the veins upon the leaves with bistre. The green of one and the other is done with sea-green, mixing a little masticot for the stiles. They are shadowed with sap-green.

The Jasmin.—It is done with a lay of white, and shadowed with black and white; and for the outside of the leaves, they mix a little bistre; making the half of each, on this side, a little reddish with carmine.

The Tuberose.—For the doing of this, they make a lay of white, and shadow with black, with a little bistre in some places; and for the outside of the leaves they mix a little carmine, to give them a reddish taint, particularly upon the extremities. The seed is done with masticot, and shadowed with sap-green. The green of it is laid with verditer, and shadowed with sap-green.

The Hellebore.—The flower of hellebore is done almost in the same manner; that is, let it be laid with white, and shadowed with black and bistre, making the outside of the leaves a little reddish here and there. The seed is laid with dark green, and raised with masticot. The green of it is foul and rusty, and is formed with verditer, masticot, and bistre; and finished with sap-green and bistre.

The White lily.—It is laid with white, and shadowed with black and white. The seed is done with orpiment and gall-stone. And the green is done as in the tuberose.

The Snow-drop.—It is formed and finished as the white lily. The seed is laid with masticot, and shadowed with gall-stone. And the green is done with sea and sap-green.

The Jonquil.—It is laid with masticot and gall-stone, and finished with gamboge and gall-stone. The green is formed with sea-green, and shadowed with sap-green.

The Daffodil.—All daffodils, the yellow, the double, and the single, are done by putting a lay of masticot: they are formed with gamboge, and finished by adding umber and bistre; excepting the bell in the middle, which is done with orpiment and gall-stone, bordered or edged with vermilion and carmine. The white are laid with white, and shadowed with black and white; excepting the cup or bell, which is done with masticot and gamboge. The green is sea-green, shadowed with sap-green.

The Marigold.—It is done by putting a lay of masticot, and then one of gamboge; shadowing it with this very colour, after vermilion is mixed with it: and for finishing, they add gall-stone and a little carmine. The green is done with verditer, shadowed with sap-green.

The Austrian Rose.—For making the Austrian rose, they put a lay of masticot, and another of gamboge. Then they form it, mixing gall-stone; and finish it with the last colour, adding bistre and a very small matter of carmine in the deepest shades.

The Indian Pink, or *French Marigold.*—It is done by putting a lay of gamboge; shadowing it with this colour, after you have mixed a good deal of carmine and gall-stone with it; and leaving about the leaves a little yellow border of gamboge, very clear in the lights, and darker in the shades. The seed is shadowed with bistre. The green, as well of the rose as the pink, is formed with verditer, and finished with sap-green.

The Sun-flower.—It is formed with masticot and gamboge, and finished with gall-stone and bistre. The green is laid with verditer and masticot, and shadowed with sap-green.

The Passion-flower.—It is done as the rose, and the green of the leaves likewise; but the veins are done with a darker green.

Poetical pinks and Sweet-william.—They are done by putting a lay of lake and white; shadowing them with pure lake, with a little carmine for the last; which are afterwards dotted on all parts with little round dots, separate from one another; and the threads in the middle are raised with white. The green of them is sea-green, which is finished with sap-green.

The Scabious.—There are two sorts of scabious, the red and the purple. The leaves of the first are laid with Florentine lake, in which there is a little white; and shadowed without white: and for the middle, which is a great boss or husk in which the seed lies, it is formed and finished with pure lake, with a little ultramarine or indigo to make it darker. Then they make little white longish dots over it, at a pretty distance from one another, clearer in the light than in the shade, making them go every way. The other is done by putting a lay of very pale purple, as well upon the leaves as the boss in the middle; shadowing both with the same colour, a little deeper: and instead of little white touches for the seed, they make them purple; and about each grain they make out a little circle, and this over the whole boss or husk in the middle. The green is formed with verditer and masticot, and shadowed with sap-green.

The Sword or *Day-lily*.—It is laid with Florence lake and very pale white; formed and finished with pure lake, very clear and bright in some places, and very dark in others; mixing even bistre in the thickest of the shades. The green is verditer, shadowed with sap-green.

Hepatica, or *Liverwort.*—There is red and blue. The last is done by putting on all parts a lay of ultramarine, white, and a little carmine or lake; shadow-

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ing the inside of the leaves with this mixture, but deeper; excepting those of the first rank; for which, and for the outside of every one of them, they add indigo and white, that the colour may be paler, and not so fine. The red is laid with lake-columbine and very pale white; and finished with less white. The green is done with verditer, masticot, and a little bistre; and shadowed with sap-green, and a little bistre, especially on the outside of the leaves.

The Pomegranate.—The flower of the pomegranate is laid with red lead; shadowed with vermilion and carmine; and finished with this last colour. The green is laid with verditer and masticot, and shadowed with sap-green.

The Flower of the Indian Bean.—It is done with a lay of Levant-lake and white; shadowing the middle leaves with pure lake; and adding a little ultramarine for the others. The green is verditer, shadowed with sap-green.

The Columbine.—There are columbines of several colours: the most common are the purple, the gridelin, and the red. For the purple, they lay with ultramarine, carmine, and white; and shadow with this mixture, deeper. The gridelin are done the same way, putting a great deal less ultramarine than carmine. The red are done with lake and white, finishing with less white. There are some mixed flowers of this kind, of several colours; which must be formed and finished as the others, but paler, making the mixtures of a little darker colour.

The Lark's Heel.—These are of different colours, and of mixed colours: the most common are the purple, the gridelin, and the red; which are done as the columbines.

Violets and Pansies.—Violets and pansies are done the same way; excepting that in the last the two middle leaves are bluer than the others, that is, the borders or edges; for the inside of them is yellow: and there little black veins are made, which take their beginning from the heart of the flower, and die away towards the middle.

The Muscipula, or *Catch-fly*.—There are two sorts of it, the white and the red; the last is laid with lake and white, with a little vermilion, and finished with pure lake. As for the knot or nozzle of the leaves, it is formed with white and a very small matter of vermilion, mixing bistre or gall-stone to finish it. The leaves of the white are laid with white; adding bistre and masticot upon the knots, which are shadowed with pure bistre, and the leaves with black and white. The green of all these flowers is done with verditer and masticot, and shadowed with sap green.

The Crown Imperial.—There are of two colours, the yellow and the red. The first is done by putting a lay of orpiment, and shadowing it with gall-stone and orpiment, with a little vermilion. The other is laid with orpiment and vermilion, and shadowed with gall-stone and vermilion; making the beginning of the leaves next the stile, with lake and bistre, very dark; and veins with this mixture, both in one and the other, all along the leaves. The green is done with verditer and masticot, shadowed with sap-green and gamboge.

The Cyclamen, or *Sowbread*.—The red is laid with carmine, a little ultramarine, and much white; and finished with the same colour, deeper; putting, in a manner, only carmine in the middle of the leaves, next the heart, and in the rest add a little more ultramarine. The other is laid with white, and shadowed with black. The stalks of one and the other ought to be a little reddish; and the green, verditer and sap-green.

The Gilliflower.—There are several sorts of gilliflowers; the white, the yellow, the purple, the red, and the mixed, of various colours. The white are laid with white, and shadowed with black, and with a little indigo in the heart of the leaves. The yellow, with masticot, gamboge, and gall-stone. The purple are formed with purple and white; and finished with less white; making the colour brighter in the heart, and even a little yellowish. The red with lake and white; finishing them with white. The mixed-coloured are laid with white, and the mixtures are sometimes made with purple, in which there is much ultramarine; others again, in which there is more carmine. Sometimes they are of lake, and sometimes of carmine. Some are done with white, and others without white; shadowing the rest of the leaves with indigo. The seed of all is formed with verditer and masticot, and finished with sap-green. The leaves and stiles are laid with the same green, mixing sap-green to finish them.

Fruits, fishes, serpents, and all sorts of reptiles, are to be touched in the same manner as the figures of men are; that is, hatched or dotted.

Birds and all other animals are done like flowers, by strokes or traces.

Never make use, for any of these things, of white-lead. It is only proper in oil. It blackens like ink, when only tempered with gum; especially if you set your work in a moist place, or where perfumes are. Ceruss of Venice is as fine, and of as pure a white. Be not sparing in the use of this, especially in forming or dead colouring; and let it enter into all your mixtures, in order to give them a certain body, which will render your work gluish, and make it appear soft, plump, and strong.

The taste of painters is, nevertheless, different in this point. Some use a little of it, and others none at all. But the manner of the last is meagre and dry. Others use a great deal; and doubtless it is the best method, and most followed among skilful persons: for besides that it is speedy, one may by the use of it copy all sorts of pictures; which would be almost impossible otherwise; notwithstanding the contrary opinion of some, who say, that in miniature we cannot give the force and all the different taints we see in pieces in oil. But this is not true, at least of good painters; and effects prove it pretty plainly: for we see figures, landscapes, pictures, and every thing else in miniature, touched in as grand, as true, and as noble a manner (though more tender and delicate), as they are in oil.

However, painting in oil has its advantages; were they only these, that it exhibits more work, and takes up less time. It is better defended likewise against the injuries of time; and the right of birth must be granted it, and the glory of antiquity.

But miniature likewise has its advantages; and without repeating such as have been mentioned already, it is neater and more commodious. You may easily carry all

Of Flowers.

all your implements in your pockets, and work when and wherever you pleafe, without fuch a number of preparations. You may quit and refume it when and as often as you will; which is not done in the other; in which one is rarely to work dry.

To conclude: In the art of painting, excellence does not depend upon the greatnefs of the fubject, but upon the manner in which it is handled. Some catch the airs of a face well; others fucceed better in landfcapes: fome work in little who cannot do it in large: fome are fkilled in colours who know little of defign: others, laftly, have only a genius for flowers: and even the Baffans got themfelves a fame for animals; which they touched in a very fine manner, and better than any thing elfe.

Minim || Minium.

MINIM, in mufic, a note equal to two crotchets, or half a femibreve. See Music.

MINIMS, a religious order in the church of Rome, founded by St Francis de Paula, towards the end of the 15th century. Their habit is a coarfe black woollen ftuff, with a woollen girdle, of the fame colours, tied in five knots. They are not permitted to quit their habit and girdle night nor day. Formerly they went bare-footed, but are now allowed the ufe of fhoes.

MINIMUM, in the higher geometry, the leaft quantity attainable in a given cafe.

MINISTER, a perfon who preaches, performs religious worfhip in public, adminifters the facraments, &c.

Minister of State, a perfon to whom the prince intrufts the adminiftration of government. See Council.

Foreign Minister, is a perfon fent into a foreign country, to manage the affairs of his province or of the ftate to which he belongs. Of thefe there are two kinds: thofe of the firft rank are ambaffadors and envoys extraordinary, who reprefent the perfons of their fovereigns; the minifters of the fecond rank are the ordinary refidents.

MINIUM, or Red-lead, is a calx of lead of a vivid red colour, which colour it acquires by a flow calcination and reverberation. See Chemistry, n°1213. The minium in commerce is chiefly brought from Holland, where large quantities of it are manufactured.

The method in which minium is made in large quantities with us is this—They firft burn lead in a furnace into a kind of litharge, by continually ftirring it while melted with an iron rake; this they afterwards grind with two pair of ftones, which deliver it from one to another, the firft pair grinding it coarfer, the fecond finer; thefe are worked by means of a mill which moves fix pair of them at once. When thus reduced to a fine powder, it is wafhed and then put into a furnace, and is burnt with a reverberatory fire for two or three days, all the while they continue ftirring it with a large iron rake, hung on a fwivel or iron hook; and toward the end of the time they watch its being of the right colour. When this is doing, the fire muft not be carried beyond a certain degree, left the matter clod and run together.

Mem. de Acad. Royal, 1770.

The procefs by which minium is prepared is defcribed in the following manner by M. Jars *. The furnace is of the reverberatory kind, with two fire-places at the ends; each fire-place being feparated from the area, or body of the furnace, by a wall twelve inches high. The fire-places are fifteen inches broad, and their length is equal to the breadth of the whole furnace, which is about eight or nine feet. The length of the area from one place to the other is nine or ten feet. The quantity of lead ufed in one operation is about 1500 pounds, of which nine parts are lead obtained from furnaces where the ore is fmelted, and one part is lead extracted from the fcoria which is formed in fmelting the ore. This latter kind is faid to be neceffary, as the former could not alone be reduced into powder. All the lead is at once put into the area, the bottom of which is level. The calx, as faft as it is formed, is drawn to one fide, by means of a rake fufpended by a chain before the mouth of the furnace. In four or five hours the whole quantity of the lead is calcined, or, if any pieces remain uncalcined, they are feparated, and kept for the next operation. The heat employed is that of a cherry-red, and the fire-places and mouth are kept open, that the air may accelerate the calcination. The powder or calx is to be frequently ftirred to prevent its concreting; and when this operation has been continued about 24 hours, the matter is taken out of the furnace, and laid on a flat pavement. Then cold water is thrown on it, to give it weight, as the workmen fay; but rather (as M. Jars thinks) to make it friable. It is then to be ground in a mill, and the finer part is feparated by wafhing, while the coarfer part, referved for fome following operation, is to be placed at the mouth of the furnace in order to retain the melted lead. The fine powder, which is now of a yellow colour, is again put into the fame or a fimilar furnace, and expofed to a very moderate fire, from 36 to 48 hours; during which time, it is ftirred frequently to prevent its concreting; and the powder gradually acquires its proper red colour. The minium is then to be taken out of the furnace, cooled, and fifted through an iron fieve placed in a cafk.

The bright colour of minium might render it valuable in painting, if it could ftand with certainty in either oil or water. But as it is fubject to become black, it cannot be fafely trufted, except in hard varnifhes: and is, therefore, feldom ufed in oil, or even in water, unlefs for very grofs purpofes, or as a ground for vermilion. The goodnefs of minium may be diftinguifhed by the brightnefs of its colour: and the adulteration to which it is liable may be detected by putting an ounce of it into a crucible with an equal quantity of charcoal duft, well mixed together, and placing the crucible in a common fire fufficient to melt lead, which is to be covered with another fmall crucible inverted into it. When it has been continued for fome time on the fire, take it out and ftrike it

againſt the ground. The minium will thus be reduced to its metallic ſtate; and its diminiſhed weight, when freed from the charcoal duſt and cold, will indicate the proportion of adulterated matter. Minium is alſo uſed as a flux in forming the enamel for grounds, and in glazing, &c.

In medicine, minium is uſed as an external application. It obtunds the acrimony of the humours, allays inflammations, and is excellent in the cleanſing and healing of old ulcers: It is uſed on theſe occaſions in many of the plaſters and ointments of the ſhops. It was an ingredient in the officinal compoſition called *emplaſtrum deminio*, employed as a deſiccative and cicatrizer; but now diſuſed for that made in the ſame manner with litharge, becauſe it does not ſtick ſo well, and is more difficult of preparation.

MINNIN, a ſtringed inſtrument of muſic among the ancient Hebrews, having three or four chords to it. See Plate CCCXIV. Though there is reaſon to queſtion the antiquity of this inſtrument; both becauſe it requires a hair-bow, which was a kind of plectrum not known to the ancients, and becauſe it ſo much reſembles the modern viol. Kircher took the figures of this, the machul, chinnor, and pſaltery, from an old book in the Vatican library.

MINOR, a Latin term, literally denoting *leſs*; uſed in oppoſition to *major*, greater.

Minor, in law, denotes a perſon under age; or who, by the laws of the country, is not yet arrived at the power of adminiſtering his own affairs, or the poſſeſſion of his eſtate. Among us, a perſon is a minor till the age of twenty-one: before which time his acts are invalid. See Age, and Infant.

It is a maxim in the common law, that in the King there is no minority, and therefore he hath no legal guardian; and his royal grants and aſſents to acts of parliament are good, though he has not in his natural capacity attained the legal age of twenty-one. It is alſo provided by the cuſtom and law of parliament, that no one ſhall ſit or vote in either houſe, unleſs he be twenty-one years of age. This is likewiſe expreſsly declared by ſtat. 7 and 8 Will. III. cap. 25. with regard to the houſe of commons.

Minor, in logic, is the ſecond propoſition of a formal or regular ſyllogiſm, called alſo the *aſſumption*.

Minor, in muſic, is applied to certain concords, which differ from or are lower than others of the ſame denomination by a leſſer ſemitone or four commas. Thus we ſay, a third minor, or leſſer third, or a ſixth major and minor. Concords that admit of major and minor, i. e. greater and leſs, are ſaid to be imperfect concords.

MINORCA, an iſland of the Mediterranean, ſituated between 39 and 40 degrees of North Latitude, and near four degrees of Eaſt Longitude. It is about 33 miles in length from north-weſt to ſouth-eaſt, in breadth from eight to twelve, but in general about ten miles; ſo that in ſize it may nearly equal the county of Huntingdon or Bedfordſhire. The form is very irregular; and the coaſts are much indented by the ſea, which forms a great number of little creeks and inlets, ſome of which might be very advantageous.

This iſland is one of thoſe called by the ancient Romans *Baleares*, which aroſe from the dexterity of the inhabitants in uſing the ſling. It fell under the power of the Romans, afterwards of the northern barbarians, who deſtroyed that empire. From them it was taken by the Arabs, who were ſubdued by the king of Majorca, and he by the king of Spain. The Engliſh ſubdued it in 1708, and the French in the late war; but it was reſtored to Britain by the treaty of Paris in 1763.

The air of this iſland is much more clear and pure than in Britain; being ſeldom darkened with thick fogs: yet the low valleys are not free from miſts and unwholeſome vapours; and in windy weather the ſpray of the ſea is driven over the whole iſland. Hence it happens that utenſils of braſs or iron are extremely ſuſceptible of ruſt, in ſpite of all endeavours to preſerve them; and houſehold-furniture becomes mouldy. The ſummers are dry, clear, calm, and exceſſively hot; the autumns moiſt, warm, and unequal; at one time perfectly ſerene, at another cloudy and tempeſtuous. During the winter there are ſometimes violent ſtorms, though neither frequent nor of long continuance; and whenever they ceaſe, the weather returns to its uſual ſerenity. The ſpring is always variable, but reſembles the winter more than the ſummer. The changes of heat and cold are neither ſo great nor ſo ſudden in this climate as in many others. In the compaſs of a year, the thermometer ſeldom riſes much above the 80th, or falls below the 48th degree. In ſummer there is ſcarcely ever a difference of four or five degrees between the heat of the air at noon and at night; and in winter the variation is ſtill leſs conſiderable. But this muſt be underſtood of a thermometer ſhaded from the influence of the ſolar beams: for if expoſed to them it will often riſe 12, 14, or 16 degrees higher than what we have mentioned; and in other ſeaſons the difference between the heat of the air in the ſun and the ſhade is much greater. Yet, even in the dog-days, the heat of the atmoſphere, at leaſt in open places, ſeldom ſurpaſſes that of human blood. The winds are very boiſterous about the equinoxes, and ſometimes during the winter. At other times they are generally moderate, and, according to the obſervations of ſeamen, they rarely blow in the ſame direction near the iſlands adjacent to the gulph of Lyons as in the open ſea. During the ſummer there is commonly a perfect calm in the mornings and evenings: but the middle of the day is cooled by refreſhing breezes which come from the eaſt, and, following the courſe of the ſun, increaſe gradually till two or three in the afternoon; after which they inſenſibly die away as night approaches. This renders the heat of the ſun leſs dangerous and inconvenient; and if theſe breezes intermit for a day or two, the natives grow languid and inactive from the heat. The northerly winds in general are clear and healthy, diſpel the miſts, and make a clear blue ſky; whilſt thoſe which blow from the oppoſite quarter, render the air warm, moiſt, and unhealthy. The north wind is ſuperior in power to all the reſt; which appears from hence, that the tops of all the trees incline to the ſouth, and the branches on the north ſide are bare and blaſted. The next to it in force is the north-weſt. Both are frequent towards the cloſe of winter and in the ſpring; and, being dry and cold, they ſhrivel up the leaves of the vegetables, deſtroy their tender ſhoots, and are often exceſſively detrimental to the vineyards and ri-

ſing

Minorca. ſing corn. The piercing blaſts at that ſeaſon from the north-eaſt, as they are more moiſt, and more frequently attended with rain, are leſs prejudicial. The ſouth and ſouth-eaſt winds are by much the moſt unhealthy. In whatever ſeaſons they blow, the air is foggy, and affects the breathing; but in the ſummer ſeaſon they are ſultry and ſuffocating. An exceſſive dejection of ſpirits is then a univerſal complaint; and on expoſing the thermometer to the rays of the ſun, the mercury has frequently riſen above the 100th degree. The weſt wind is uſually drier than the ſouth: the eaſt is cold and bluſtering in the ſpring, and ſultry in the ſummer.

The weather in Minorca is generally fair and dry; but when it rains, the ſhowers are heavy, though of ſhort continuance, and they fall moſt commonly in the night. The ſky in ſummer is clear, and of a beautiful azure, without clouds or rain; but moderate dews deſcend regularly after ſunſet. In autumn the weather becomes leſs ſerene; whirlwinds and thunder become frequent; and in the night-time lightning, and thoſe meteors called *falling ſtars*, are very common. Water-ſpouts alſo are often ſeen at that ſeaſon, and frequently break upon the ſhore. A ſudden alteration in the weather takes place about the autumnal equinox; the ſkies are darkened with clouds, and the rains fall in ſuch quantities, that the torrents thereby occaſioned, pouring down from the hills, tear up trees by the root, carry away cattle, break down fences, and do conſiderable miſchief to the gardens and vineyards. But theſe anniverſary rains are much more violent than laſting; always falling in ſudden and heavy ſhowers, with intervals of fair weather. They are accompanied with thunder, lightning, and ſquals of wind, moſt commonly from the north. Hail and ſnow are often intermixed with the rains which fall in winter and in ſpring; but the ſnow, for the moſt part, diſſolves immediately; and ice is here an uncommon appearance.

The whole coaſt of Minorca lies low; and there are only a few hills near the centre, of which the moſt conſiderable, named *Toro* by the inhabitants, may be ſeen at the diſtance of 12 or 14 leagues from the land. The ſurface of the iſland is rough and unequal; and in many places divided by long narrow vales of a conſiderable depth, called *barancoes* by the natives. They begin towards the middle of the iſland, and after ſeveral windings terminate at the ſea. The ſouth-weſt ſide is more plain and regular than towards the north-eaſt; where the hills are higher, with low marſhy valleys betwixt them, the ſoil leſs fruitful, and the whole tract unhealthy to man and beaſt. Near the towns and villages the fields are well cultivated, and incloſed with ſtone-walls; but the reſt for the moſt part are rocky, or covered with woods and thickets. There are ſome pools of ſtanding water, but very few rivulets, which is the greateſt defect about the iſland, as the inhabitants have ſcarcely any wholeſome water excepting what is ſaved from the clouds.

The ſoil is light, thin, and very ſtony, with a good deal of ſea-ſalt, and, in ſome places, of calcareous nitre intermixed. In moſt places there is ſo little earth, that the iſland appears to be but one large irregular rock covered here and there with mould, and an infinite variety of ſtones. Notwithſtanding this, however, it is not only extremely proper for vineyards, but produces more wheat and barley than could at firſt ſight be imagined; and, if the peaſants may be credited, it would always yield a quantity of corn and wine ſufficient for the natives, did not the violence of the winds, and the exceſſive drought of the weather, frequently ſpoil their crops. The fields commonly lie fallow for two years, and are ſown the third. About the latter end of winter, or the beginning of ſpring, they are firſt broke up: and next autumn, as ſoon as the rains fall, they are again ploughed and prepared for receiving the proper ſeeds. The tillage is very eaſily performed; for a plough ſo light as to be tranſported from place to place on the ploughman's ſhoulder, and to be drawn by an heifer, or an aſs ſometimes aſſiſted by an hog, is ſufficient for opening ſo thin a ſoil. The later the harveſt happens, the more plentiful it proves. The barley is uſually cut down about the 20th of May N. S. and the wheat is reaped in June, ſo that the whole harveſt is commonly got in by midſummer-day. The grain is not threſhed with flails as in this country, but trodden out on a ſmooth piece of rock by oxen and aſſes, according to the cuſtom of the eaſtern nations.

The natives of Minorca are commonly lean, thin, and well-built, of a middle ſtature, and olive complexion; but their character is by no means agreeable. Such is the natural impetuoſity of their temper, that the ſlighteſt cauſe provokes them to anger, and they ſeem to be incapable of forgiving or forgetting an injury. Hence quarrels break out daily, even among neighbours and relations; and family diſputes are tranſmitted from father to ſon; and thus, though lawyers and pettifoggers are very numerous in this country, there are ſtill too few for the clients. Both ſexes are, by conſtitution, extremely amorous: they are often betrothed to each other while children, and marry at the age of 14. The women have eaſy labours, and commonly return in a few days to their uſual domeſtic buſineſs; but, leſt the family ſhould become too numerous for their income, it is a practice among the poorer ſort to keep their children at the breaſt for two or three years, that by this means the mothers may be hindered from breeding.

Bread of the fineſt wheat flour, well fermented and well baked, is more than half the diet of people of all ranks. Rice, pulſe, vermicelli, herbs and roots from the garden, ſummer-fruits, pickled olives, and pods of the Guinea pepper, make up almoſt all the other half, ſo that ſcarce a fifth of their whole food is furniſhed from the animal kingdom, and of this fiſh makes by much the moſt conſiderable portion. On Fridays, and other faſt days, they abſtain entirely from fleſh; and during Lent they live altogether on vegetables and fiſh, excepting Sundays, when they are permitted the uſe of eggs, cheeſe, and milk. Moſt of their diſhes are high-ſeaſoned with pepper, cloves, cinnamon, and other ſpices; and garlic, onions, or leeks, are almoſt conſtant ingredients. They eat a great deal of oil, and that none of the ſweeteſt or beſt flavoured; uſing it not only with ſallads, but alſo with boiled and fried fiſh, greens, pulſe, &c. inſtead of butter. A ſlice of bread ſoaked in boiled water, with a little oil and ſalt, is the common breakfaſt of the peaſants, well known by the name of *oleagua*. Their ordinary meals are

Minorca. very frugal, and consist of very little variety; but on festivals and other solemn occasions their entertainments are to the last degree profuse and extravagant, insomuch that the bill of fare of a country farmer's wedding-dinner would scarce be credited.

With regard to other matters, the Minorquins are accused of prodigious indolence in the way of business, and neglect of the natural advantages they possess. In the bowels of the earth are iron, copper, and lead-ores, of none of which any use hath been made except the last. A lead-mine was worked to advantage some time ago, and the ore sent into France and Spain for the use of the potteries in those countries. The proprietor discontinued his work on some small discouragement; and indeed it is said, that these people are of all mankind the most easily put out of conceit with an undertaking that does not bring them in mountains of present gain, or that admits of the slightest probability of disappointing their most sanguine expectations: nor will their purse admit of many disappointments; and thus their poverty co-operating with their natural despondence and love of ease, is the principal cause of their backwardness to engage in projects, though ever so promising, for the improvement of their private fortune, and the advantage of the commerce of their country. This lead-ore went under the name of *vernis* among the natives, as it was wholly used by the potters in varnishing and glazing their earthen vessels.

There are few exports of any account, and they are obliged to their neighbours for near one-third of their corn, all their oil, and such a variety of articles of less consideration, that nothing could preserve them from a total bankruptcy, but the English money circulated by the troops, which is exchanged for the daily supplies of provisions, increased by the multiplication of vineyards, the breeding of poultry, and the production of vegetables, in a proportion of at least five to one since the island has been in our possession. It will not require many words to enumerate their exports: they make a sort of cheese, little liked by the English, which sells in Italy at a very great price; this, perhaps, to the amount of 800 l. *per annum.*—The wool they send abroad may produce 900 l. more. Some wine is exported; and, if we add to its value that of the home-consumption, which has every merit of an export, being nine parts in ten taken off by the troops for ready money, it may well be estimated at 1600 l. a-year. In honey, wax, and salt, their yearly exports may be about 400 l. and this comes pretty near the sum of their exports, which we estimate together at 18,000 l. Sterling *per annum.*

A vast balance lies against them, if we consider the variety and importance of the articles they fetch from other countries, for which they must pay ready cash. Here it may be necessary to withdraw some things from the heap, such as their cattle, sheep, and fowls, on which they get a profit; for the country does not produce them in a sufficient abundance to supply them, especially when we have a fleet of men of war stationed there.

Their imports are, corn, cattle, sheep, fowls, tobacco, oil, rice, sugar, spices, hard-ware, and tools of all kinds; gold and silver lace; chocolate, or cocoa to make it; tobacco, timber, plank, boards, mill-stones, tobacco-pipes, playing cards, turnery ware, seeds, soap, saddles; all manner of cabinet-makers work, iron spikes, nails, fine earthen-ware, glass-lamps, brasiery, paper, and other stationary wares; copperas, galls, dye-stuffs, painters brushes, and colours; musical instruments, music, and strings; watches, wine, fruit, all manner of fine and printed linens, muslins, cambrics, and laces; bottles, corks, starch, indigo, fans, trinkets, toys, ribbands, tape, needles, pins, silk, mohair, lanthorns, cordage, tar, pitch, rosin, drugs, gloves, fire-arms, gunpowder, shot, and lead; hats, caps, velvet, cotton stuffs, woollen cloths, stockings, capes, medals, vestments, lustres, pictures, images, agnus Dei's, books, pardons, bulls, relics, and indulgencies.

The island is divided into what they style *terminos*, of which there were anciently five, now reduced to four, and resemble our counties. The termino of Ciudadella, at the north-western extremity of the island, is so styled from this place, which was once a city, and the capital of Minorca. It makes a venerable and majestic figure, even in its present state of decay, having in it a large Gothic cathedral, some other churches and convents, the governor's palace, and an exchange, which is no contemptible pile.—There are in it 600 houses, which, before the seat of government and the courts of justice were removed to Mahon, were fully inhabited; and there are still more gentlemens families here than in all the rest of the island. It hath a port commodious enough for the vessels employed in the trade of this country, which, though in the possession of a maritime power, is less than it formerly was. It is still, in the style of our officers, *the best quarters* (and there are none bad) in the country; and if there was a civil government, and the place made a free port, the best judges are of opinion it would very soon become a flourishing place again; and the fortifications, if it should be found necessary, might then also be easily restored and improved.

The termino of Fererias is the next, a narrow slip reaching cross from sea to sea, and the country little cultivated; it is therefore united to Mercandal. In this last termino stands Mont-toro in the very centre of the isle, and the highest ground, some say the only mountain in it; on the summit of which there is a convent, where even in the hottest months the monks enjoy a cool air, and at all times a most delightful prospect. About six miles north from Mont-toro stands the castle that covers Port Fornelles, which is a very spacious harbour on the east side of the island. There are in it shoals and foul ground, which, to those who are unacquainted with them, render it difficult and dangerous; yet the packets bound from Mahon to Marseilles frequently take shelter therein; and while the Spaniards were in possession of the isle, large ships and men of war frequented it. At a small distance from this lies another harbour called *Adaia*, which runs far into the land; but being reputed unsafe, and being so near Fornelles, is at present useless. The country about it is, however, said to be the pleasantest and wholesomest spot in the island, and almost the only one plentifully supplied with excellent spring-water; so that the gardens are well laid out, and the richest and finest fruits grow here in the highest perfection. Alaior is the next termino, in which there is nothing remarkable

remarkable but the capital of the fame name, well fituated on an eminence, in a pleafant and tolerably cultivated country.

The termino of Mahon, at the fouth-eaft end of the ifland, is at prefent the moft confiderable of them all, containing about 60,000 Englifh acres, and nearly one-half of the inhabitants in Minorca. The town of Mahon derives its name from the Carthaginian general Mago, who is univerfally allowed to be its founder.—It ftands on an eminence on the weft fide of the harbour, the afcent pretty fteep. There are in it a large church, three convents, the governor's palace, and fome other public edifices. It is large, but the ftreets are winding, narrow, and ill-paved. The fortrefs of St Philip ftands near the entrance of the harbour, which it covers, is very fpacious, of great ftrength, with fubterranean works to protect the garrifon from bombs, large magazines, and whatever elfe is neceffary to render it a complete fortification, and hath a numerous and well-difpofed artillery. Port Mahon is allowed to be the fineft harbour in the Mediterranean, about 90 fathoms wide at its entrance, but within very large and fafe, ftretching a league or more into the land. Beneath the town of Mahon there is a very fine quay, one end of which is referved for the fhips of war, and furnifhed with all the accommodations neceffary for careening and refitting them; the other ferves for merchantmen. On the other fide the harbour is Cape Mola, where it is generally agreed a fortrefs might be conftructed which would be impregnable, as the caftle of St Philip was efteemed before we took it, and beftowed fo much money upon it, that, though fome works were erected at Cape Mola, it was not judged proper to proceed in the fortifications there at a frefh expence; at leaft this is the only reafon that hath been affigned. Minorca was taken by the Spaniards during the American war, and is now in their poffeffion.

MINORS, or Friers Minor, an appellation which the Francifcans affume, out of fhew of humility; calling themfelves *fratres minores*, i. e. leffer brothers, and fometimes *minorites*. There is alfo an order of regular minors at Naples, which was eftablifhed in the year 1588, and confirmed by Sixtus V.

MINOS (fab. hift.), a king of Crete, fon of Jupiter and Europa. He flourifhed about 1432 years before the Chriftian era. He gave laws to his fubjects, which ftill remained in full force in the age of the philofopher Plato, about 1000 years after the death of the legiflator. His juftice and moderation procured him the appellation of the favourite of the gods, the confident of Jupiter, and the wife legiflator, in every city of Greece; and, according to the poets, he was rewarded for his equity after death with the office of fupreme and abfolute judge in the infernal regions. In this capacity he is reprefented fitting in the middle of the fhades, and holding a fceptre in his hand. The dead plead their different caufes before him; and the impartial judge fhakes the fatal urn, which is filled with the deftinies of mankind. He married Ithona, by whom he had Lycaftes, who was the father of Minos II.

Minos II. was a fon of Lycaftes, the fon of Minos I. and king of Crete. He married Pafiphae, the daughter of Sol and Perfeis, and by her he had many children. He increafed his paternal dominions by the conqueft of the neighbouring iflands; but fhowed himfelf cruel in the war which he carried againft the Athenians, who had put to death his fon Androgeus. He took Megara by the treachery of Scylla; and not fatisfied with victory, he obliged the vanquifhed to bring him yearly to Crete feven chofen boys and the fame number of virgins to be devoured by the Minotaur. This bloody tribute was at laft abolifhed when Theseus had deftroyed the monfter. When Dædalus, whofe induftry and invention had fabricated the labyrinth, and whofe imprudence in affifting Pafiphae in the gratification of her unnatural defires, had offended Minos, fled from the place of his confinement with wings, and arrived fafe in Sicily; the incenfed monarch purfued the offender, refolved to punifh his infidelity. Cocalus, king of Sicily, who had hofpitably received Dædalus, entertained his royal gueft with diffembled friendfhip; and, that he might not deliver to him a man whofe ingenuity and abilities he fo well knew, he put Minos to death. Minos died about 35 years before the Trojan war. He was father of Androgeus, Glaucus, and Deucalion; and two daughters, Phædra and Ariadne. Many authors have confounded the two Minofes, the grandfather and the grandfon; but Homer, Plutarch, and Diodorus, prove plainly that they were two different perfons.

MINOTAUR (fab. hift.), a celebrated monfter, half a man and half a bull, according to this verfe of Ovid,

Semibovemque virum, femivirumque bovem.

It was the fruit of Pafiphae's amour with a bull. Minos refufed to facrifice a white bull to Neptune, an animal which he had received from the god for that purpofe. This offended Neptune, and he made Pafiphae the wife of Minos enamoured of this fine bull, which had been refufed to his altars. Dædalus proftituted his talents in being fubfervient to the queen's unnatural defires; and by his means, Pafiphae's horrible paffions were gratified, and the Minotaur came into the world. Minos confined in the labyrinth this monfter, which convinced the world of his wife's lafcivioufnefs, and reflected difgrace upon his family. The Minotaur ufually devoured the chofen young men and maidens which the tyranny of Minos yearly exacted from the Athenians. Thefeus delivered his country from this tribute, when it had fallen to his lot to be facrificed to the voracity of the Minotaur; and by means of Ariadne, the king's daughter, he deftroyed the monfter, and made his efcape from the windings of the labyrinth.—The fabulous tradition of the Minotaur, and of the infamous commerce of Pafiphae with a favourite bull, has been often explained. Some fuppofe that Pafiphae was enamoured of one of her hufband's courtiers called *Taurus*; and that Dædalus favoured the paffions of the queen, by fuffering his houfe to become the retreat of the two lovers. Pafiphae fome time after brought twins into the world, one of whom greatly refembled Minos and the other Taurus; and in the natural refemblance of their countenance with that of their fuppofed fathers, originated their name, and confequently the fable of the Minotaur.

MINOW, a very fmall fpecies of cyprinus, fo well known that it needs no defcription.

Minfter, Minftrel.

MINSTER (Saxon, *Mynfter* or *Mynftre*), anciently fignified the church of a monaftery or convent.

MINSTREL, an ancient term for a finger and inftrumental performer.

The word *minftrel* is derived from the French *meneftrier*, and was not in ufe here before the Norman conqueft. It is remarkable, that our old monkifh hiftorians do not ufe the word *citharædus*, *cantator*, or the like, to exprefs a *minftrel* in Latin; but either *mimus*, *hiftrio*, *joculator*, or fome other word that implies *gefture*. Hence it fhould feem that the minftrels fet off their finging by mimicry or action; or, according to Dr Brown's hypothefis, united the powers of melody, poem, and dance.

The Saxons, as well as the ancient Danes, had been accuftomed to hold men of this profeffion in the higheft reverence. Their fkill was confidered as fomething divine, their perfons were deemed facred, their attendance was folicited by kings, and they were everywhere loaded with honours and rewards. In fhort, poets and their art were held among them in that rude admiration which is ever fhown by an ignorant people to fuch as excel them in intellectual accomplifhments. When the Saxons were converted to Chriftianity, in proportion as letters prevailed among them, this rude admiration began to abate, and poetry was no longer a peculiar profeffion. The poet and the minftrel became two perfons. Poetry was cultivated by men of letters indifcriminately, and many of the moft popular rhymes were compofed amidft the leifure and retirement of monafteries. But the minftrels continued a diftinct order of men, and got their livelihood by finging verfes to the harp at the houfes of the great. There they were ftill hofpitably and refpectfully received, and retained many of the honours fhown to their predeceffors the Bards and Scalds. And indeed, though fome of them only recited the compofitions of others, many of them ftill compofed fongs themfelves; and all of them could probably invent a few ftanzas on occafion. There is no doubt but moft of the old heroic ballads were produced by this order of men. For although fome of the larger metrical romances might come from the pen of the monks or others, yet the fmaller narratives were probably compofed by the minftrels who fung them. From the amazing variations which occur in different copies of thefe old pieces, it is evident they made no fcruple to alter each other's productions, and the reciter added or omitted whole ftanzas according to his own fancy or convenience.

In the early ages, as is hinted above, this profeffion was held in great reverence among the Saxon tribes, as well as among their Danifh brethren. This appears from two remarkable facts in hiftory, which fhow that the fame arts of mufic and fong were equally admired among both nations, and that the privileges and honours conferred upon the profeffors of them were common to both; as it is well known their cuftoms, manners, and even language, were not in thofe times very diffimilar.

When King Alfred the Great was defirous to learn the true fituation of the Danifh army, which had invaded his realm, he affumed the drefs and character of a minftrel; and taking his harp, and only one attendant (for in the earlieft times it was not unufual for a minftrel to have a fervant to carry his harp), he went with the utmoft fecurity into the Danifh camp. And though he could not but be known to be a Saxon, the character he had affumed procured him a hofpitable reception; he was admitted to entertain the king at table, and ftaid among them long enough to contrive that affault which afterwards deftroyed them. This was in the year 878.

About 60 years after, a Danifh king made ufe of the fame difguife to explore the camp of King Athelftan. With his harp in his hand, and dreffed like a minftrel, Anlaff king of the Danes went among the Saxon tents, and taking his ftand near the king's pavilion, began to play, and was immediately admitted. There he entertained Athelftan and his lords with his finging and his mufic; and was at length difmiffed with an honourable reward, though his fongs muft have difcovered him to have been a Dane. Athelftan was faved from the confequences of this ftratagem by a foldier, who had obferved Anlaff bury the money which had been given him, from fome fcruple of honour or motive of fuperftition. This occafioned a difcovery.

From the uniform procedure of both thefe kings, it is plain that the fame mode of entertainment prevailed among both people, and that the minftrel was a privileged character among both. Even as late as the reign of Edward II. the minftrels were eafily admitted into the royal prefence, as appears from a paffage in Stow, which alfo fhows the fplendor of their appearance.

"In the year 1316, Edward II. did folemnife his feaft of Pentecoft at Weftminfter, in the great hall: where fitting royally at the table with his peers about him, there entered a woman adorned like a minftrel, fitting on a great horfe trapped, as minftrels then ufed, who rode round about the tables, fhowing paftime; and at length came up to the king's table, and laid before him a letter, and forthwith turning her horfe, faluted every one, and departed."—The fubject of this letter was a remonftrance to the king on the favours heaped by him on his minions, to the neglect of his knights and faithful fervants.

The meffenger was fent in a minftrel's habit, as what would gain an eafy admiffion; and was a woman concealed under that habit, probably to difarm the king's refentment: for we do not find that any of the real minftrels were of the female fex; and therefore conclude this was only an artful contrivance peculiar to that occafion.

In the 4th year of Richard II. John of Gaunt erected at Tetbury in Staffordfhire a court of minftrels, with a full power to receive fuit and fervice from the men of his profeffion within five neighbouring counties, to enact laws, and determine their controverfies; and to apprehend and arreft fuch of them as fhould refufe to appear at the faid court, annually held on the 16th of Auguft. For this they had a charter, by which they were empowered to appoint a king of the minftrels, with four officers, to prefide over them. Thefe were every year elected with great ceremony; the whole form of which is defcribed by Dr Plott: in whofe time, however, they feem to have become mere muficians.

Even fo late as the reign of King Henry VIII. the reciters of verfes or moral fpeeches learnt by heart, intruded without ceremony into all companies; not only

Minstrel. only in taverns, but in the houses of the nobility themselves. This we learn from Erasmus, whose argument led him only to describe a species of these men who did not sign their compositions; but the others that did, enjoyed without doubt the same privileges.

We find that the minstrels continued down to the reign of Elizabeth; in whose time they had lost much of their dignity, and were sinking into contempt and neglect. Yet still they sustained a character far superior to any thing we can conceive at present of the singers of old ballads.

When Queen Elizabeth was entertained at Killingworth castle by the earl of Leicester in 1575, among the many devices and pageants which were exhibited for her entertainment, one of the personages introduced was that of an ancient minstrel, whose appearance and dress are so minutely described by a writer there present, and gives us so distinct an idea of the character, that we shall quote the passage at large.

"A person very meet seemed he for the purpose, of a xlv. years old, apparelled partly as he would himself. His cap off: his head seemingly rounded tonsterwise: fair-kembed, that, with a sponge daintly dipt in a little capon's grease, was finely smoothed, to make it shine like a mallard's wing. His beard smugly shaven: and yet his shirt after the new trink, with ruffs fair starched, sleeked and glistering like a pair of new shoes, marshalled in good order with a setting stick, and strut, 'that' every ruff stood up like a wafer. A side [i. e. long] gown of Kendale green, after the freshness of the year now, gathered at the neck with a narrow gorget, fastened afore with a white clasp and a keeper close up to the chin; but easily, for heat, to undo when he list. Seemingly begirt in a red caddis girdle: from that a pair of capped Sheffield knives hanging a' two sides. Out of his bosom drawn from a lappet of his napkin edged with a blue lace, and marked with a D for Damian; for he was but a batchelor yet.

"His gown had side [i. e. long] sleeves down to mid-leg, slit from the shoulder to the hand, and lined with white cotton. His doublet-sleeves of black worsted: upon them a pair of pointes of tawny chamlet laced along the wrist with blue threaden pointes. A wealt towards the hands of fustian-a-napes. A pair of red neather-stocks. A pair of pumps on his feet, with a cross cut at his toes for corns; not new indeed, yet cleanly blackt with soot, and shining as a shoing horn.

"About his neck a red ribband suitable to his girdle. His harp in good grace dependent before him. His wrest tyed to a green lace and hanging by: under the gorget of his gown a fair flaggon chain, (pewter for) silver, as a squire Minstrel of Middlesex, that travelled the country this summer season, unto fair and worshipful mens houses. From his chain hung a scutcheon, with metal and colour, resplendent upon his breast, of the ancient arms of Islington."

—This minstrel is described as belonging to that village. We suppose such as were retained by noble families wore their arms hanging down by a silver chain as a kind of badge. From the expression of Squire Minstrel above, we may conclude there were other inferior orders, as Yeomen Minstrels, or the like.

This minstrel, the author tells us a little below, "after three lowly courtesies, cleared his voice with a hem ... and wiped his lips with the hollow of his hand for 'filing his napkin; tempered a string or two with his wrest; and, after a little warbling on his harp for a prelude, came forth with a solemn song, warranted for story out of King Arthur's acts, &c."

Towards the end of the 16th century, this class of men had lost all credit, and were sunk so low in the public opinion, that in the 39th year of Elisabeth a statute was passed by which "minstrels, wandering abroad," were included among "rogues, vagabonds, and sturdy beggars," and were adjudged to be punished as such. This act seems to have put an end to the profession, for after this time they are no longer mentioned.

MINT, the place in which the king's money is coined. See Coinage.

Mint. There were anciently mints in almost every county in England; but the only mint at present in the British dominions is that in the tower of London. The officers of the mint are, 1. The warden of the mint, who is the chief; he oversees the other officers, and receives the bullion. 2. The master-worker, who receives bullion from the warden, causes it to be melted, delivers it to the moneyers, and, when it is coined, receives it again. 3. The comptroller, who is the overseer of all the inferior officers, and sees that all the money is made to the just assize. 4. The assay-master, who weighs the gold and silver, and sees that it is according to the standard. 5. The two auditors who take the accounts. 6. The surveyor of the melting; who, after the assay-master has made trial of the bullion, sees that it is cast out, and not altered after it is delivered to the melter. 7. The engraver; who engraves the stamps and dyes for the coinage of the money. 8. The clerk of the irons; who sees that the irons are clean and fit to work with. 9. The melter who melts the bullion before it be coined. 10. The provost of the mint; who provides for and oversees all the moneyers. 11. The blanchers, who anneal and cleanse the money. 12. The moneyers; some of whom forge the money, some share it, some round and mill it, and some stamp and coin it. 13. The porters who keep the gate of the mint.

Mint was also a pretended place of privilege, in Southwark, near the King's Bench, put down by statute. If any persons, within the limits of the mint, shall obstruct any officer in the serving of any writ or process, &c. or assault any person therein, so as he receive any bodily hurt, the offender shall be guilty of felony, and be transported to the plantations, &c. Stat. 9. Geo. I.

Mint-Marks. It hath been usual, from old time, to oblige the masters and workers of the mint, in the indentures made with them, "to make a privy mark in all the money that they made, as well of gold as of silver, so that another time they might know, if need were, and witte which moneys of gold and silver among other of the same moneys, were of their own making, and which not." And whereas, after every trial of the pix at Westminster, the masters and workers of the mint, having there proved their moneys to be lawful and good, were immediately entitled to receive their *quietus* under the great seal, and to be dis-

Mint. charged from all ſuits or actions concerning thoſe moneys, it was then uſual for the ſaid maſters and workers to change the privy mark before uſed for another, that ſo the moneys from which they were not yet diſcharged might be diſtinguiſhed from thoſe for which they had already received their *quietus;* which new mark they then continued to ſtamp upon all their moneys, until another trial of the pix gave them alſo their *quietus* concerning thoſe.

The pix is a ſtrong box with three locks, whoſe keys are reſpectively kept by the warden, maſter, and comptroller of the mint; and in which are depoſited, ſealed up in ſeveral parcels, certain pieces taken at random out of every *journey* as it is called; that is, out of every 15 pounds weight of gold, or 60 pounds weight of ſilver, before the ſame is delivered to the proprietors. And this pix is, from time to time, by the king's command, opened at Weſtminſter, in the preſence of the lord-chancellor, the lords of the council, the lords-commiſſioners of the treaſury, the juſtices of the ſeveral benches, and the barons of the exchequer; before whom a trial is made, by a jury of goldſmiths impanelled and ſworn for that purpoſe, of the collective weights of certain parcels of the ſeveral pieces of gold and ſilver taken at random from thoſe contained in the pix; after which thoſe parcels being ſeverally melted, aſſays are then made of the bullion of gold and ſilver ſo produced, by the melting certain ſmall quantities of the ſame againſt equal weights taken from the reſpective trial-pieces of gold and ſilver that are depoſited and kept in the exchequer for that uſe. This is called the *trial of the pix;* the report made by the jury upon that trial is called the *verdict of the pix* for that time; and the indented trial-pieces juſt abovementioned, are certain plates of ſtandard gold and ſtandard ſilver, made with the greateſt care, and delivered in upon oath, from time to time as there is occaſion, by a jury of the moſt able and experienced goldſmiths, ſummoned by virtue of a warrant from the lords of the treaſury to the wardens of the myſtery of goldſmiths of the city of London for that purpoſe; and which plates being ſo delivered in, are divided each, at this time, into ſeven parts by indentures, one of which parts is kept in his majeſty's court of exchequer at Weſtminſter, another by the ſaid company of goldſmiths, and two more by the officers of his majeſty's mint in the tower; the remaining three being for the uſe of the mint, &c. in Scotland. The pix has ſometimes been tried every year, or even oftener, but ſometimes not more than once in ſeveral years: and from hence is underſtood how it comes to paſs, that, among the pieces that are dated as well as marked, three or more different dates are ſometimes found upon pieces impreſſed with the ſame mark; and again, that different marks are found upon pieces bearing the ſame date. Theſe marks are firſt obſervable upon the coins of King Edward III.; the words above quoted concerning thoſe marks are from the indentures made with the lord Haſtings, maſter and worker to King Edward IV.; and the marks themſelves continued to be ſtamped very conſpicuouſly upon the moneys, till the coinage by the mill and ſcrew was introduced and ſettled after the Reſtoration, in the year 1662: ſince which time, the moneys being made with far greater regularity and exactneſs than before, theſe marks have either been totally laid aſide, or ſuch only have been uſed as are of a more ſecret nature, and only known to the officers and engravers concerned in the coinage: and indeed the conſtant practice that has ever ſince prevailed, of dating all the ſeveral pieces, has rendered all ſuch marks of much leſs conſequence than before.

Mint || Minyæ.

Mint, in botany. See Mentha.

MINTURNÆ, a town of Campania between Sinueſſa and Formiæ. It was in the marſhes in this neighbourhood that Marius concealed himſelf in the mud to avoid the partizans of Sylla. The people condemned him to death; but when his voice alone had terrified the executioner, they ſhowed themſelves compaſſionate and favoured his eſcape.

MINUET, a very graceful kind of dance, conſiſting of a coupee, a high ſtep, and a balance: it begins with a beat, and its motion is triple.

The invention of the minuet ſeems generally to be aſcribed to the French, and particularly to the inhabitants of the province of Poictou. The word is ſaid by Menage and Furetiere to be derived from the French *menue* or *menu*, "ſmall, or little;" and in ſtrictneſs ſignifies a ſmall pace. The melody of this dance conſiſts of two ſtrains, which, as being repeated, are called *repriſes*, each having eight or more bars, but never an odd number. The meaſure is three crotchets in a bar, and is thus marked $\frac{3}{4}$, though it is commonly performed in the time $\frac{3}{8}$. Walther ſpeaks of a minuet in Lully's opera of *Roland*, each ſtrain of which contains ten bars, the ſectional number being 5; which renders it very difficult to dance.

MINUTE, in geometry, the 60th part of a degree of a circle.

Minute *of Time*, the 60th part of an hour.

Minute, in architecture, uſually denotes the 60th, ſometimes the 30th, part of a module. See Architecture.

Minute is alſo uſed for a ſhort memoir, or ſketch of a thing taken in writing.

MINUTIUS Felix. See Felix.

MINYÆ, a name given to the inhabitants of Orchomenos in Bœotia, from Minyas king of the country. Orchomenos the ſon of Minyas gave his name to the capital of the country; and the inhabitants ſtill retained their original appellation, in contradiſtinction to the Orchomenians of Arcadia. A colony of Orchomenians paſſed into Theſſaly and ſettled in Iolchos; from which circumſtance the people of the place, and particularly the Argonauts, were called *Minyæ*. This name they received, according to the opinion of ſome, not becauſe a number of Orchomenians had ſettled among them, but becauſe the chief and nobleſt of them were deſcended from the daughters of Minyas. Part of the Orchomenians accompanied the ſons of Codrus when they migrated to Ionia. The deſcendants of the Argonauts, as well as the Argonauts themſelves, received the name of *Minyæ*. They firſt inhabited Lemnos, where they had been born from the Lemnian women who had murdered their huſbands. They were driven from Lemnos by the Pelaſgi, about 1160 before the Chriſtian era, and came to ſettle in Laconia, from whence they paſſed into Calliſte with a colony of Lacedemonians.

Miquelets || Mirabilis.

MIQUELETS, a name given to the Spaniards who inhabit the Pyrenean mountains on the frontiers of Arragon and Catalonia, and live by robbing.

MIQUELON, a fmall defart ifland to the fouthweft of Cape May in Newfoundland, ceded to the French by the peace of 1763, for drying and curing their fifh. W. Long. 54. 30. N. Lat. 47. 22.

MIRABILIS, Marvel of Peru: A genus of the monogynia order, belonging to the pentandria clafs of plants; and in the natural method ranking with thofe of which the order is doubtful. The corolla is funnel-fhaped above; the calyx inferior; the nectarium globular, containing the germen. The moft remarkable fpecies are,

1. The jalappa, or common marvel of Peru. It has a large, thick, flefhy root; an upright, thick, jointed ftalk, dividing and branching numeroufly, widely, and erectly, a yard or more high; garnifhed with oblong, broad, oppofite leaves; and all the branches and fhoots terminated by numerous flowers in clufters, of different colours in the varieties. Of this there are varieties with white flowers—with yellow flowers—with purple flowers—with red flowers—with white and yellow flowers—white and purple flowers—purple and yellow flowers—red and yellow flowers. Several other varieties often rife from feed; and it is remarkable, that although feveral of the above colours and variegations are fometimes common to the fame plant, yet it is rare that a plant of this fpecies produces flowers of one of thofe colours alone; fometimes, however, the fame plant will exhibit only white and purple flowers feparate, and fometimes both colours in the fame flowers, intermixed with the plain ones: the fame is alfo obfervable in the red and yellow; others have plain flowers of feveral different colours, and fometimes variegated flowers alfo on the fame plants. This fpecies has a large tap root, which, when cut acrofs, is not unlike that of the true jalap; but, when dried, is white, light, and fpungy. 2. The longiflora, or long-flowered mirabilis, hath a large, thick, flefhy root; a thick ftalk, dividing low into many declinated fpreading branches, extending two or three feet every way; large, heart-formed, hairy, vifcous leaves, in oppofite pairs; and all the branches and fhoots terminated by white flowers in clufters, having very long tubes, nodding downward. 3 The dichotoma, dichotomous, or forked mirabilis, has a thick flefhy root; an upright, thick, fwollen, jointed ftem, branching forkedly two or three feet high; oblong oppofite leaves; and fmallifh red flowers at the axillas, fingly and clofe-fitting.

All thefe plants flower in July, continuing in plentiful fucceffion until October, very confpicuous and elegant. They have the fingularity of being fhut all day, and expanding towards the evening when the fun declines; hence the inhabitants of the Indies, where they grow naturally, called them *four o'clock flowers:* their time of opening here, however, depends on the weather; for if cloudy, or that the fun is not very vehement, they often open great part of the day. They are naturally perennial in root; but in this country are commonly confidered as annuals: for they rife from feed in the fpring, and the fame year produce flowers and perfect feed; and if left to nature in the open air, totally perifh in winter, at the firft attack of froft or exceffive wet. If in autumn, however, when the ftalks begin to affume a ftate of decay, the roots are taken up, and preferved in fand in a dry room all winter, and planted again in fpring, they fhoot out afrefh ftronger than at firft, and fometimes obtain four or five feet ftature, with very fpreading heads; or if plants growing in pots, having the ftems cut down in autumn, and the pots placed in a green-houfe, or garden-frames under glaffes, the roots may alfo be preferved found, and will fhoot out again in fpring as above.

The roots of all thefe plants are purgative; but require to be given in a great quantity to operate equal to the true jalap, which is a fpecies of convolvulus. See Convolvulus.

Miracle.

MIRACLE, in its original fenfe, is a word of the fame import with *wonder;* but in its ufual and more appropriate fignification, it denotes "an effect contrary to the eftablifhed conftitution and courfe of things, or a fenfible deviation from the known laws of nature."

That the vifible world is governed by ftated general rules, or that there is an order of caufes and effects eftablifhed in every part of the fyftem of nature which falls under our obfervation, is a fact which cannot be controverted. If the Supreme Being, as fome have fuppofed, be the only real agent in the univerfe, we have the evidence of experience, that, in the particular fyftem to which we belong, he acts by ftated rules. If he employs inferior agents to conduct the various motions from which the phenomena refult, we have the fame evidence that he has fubjected thofe agents to certain fixed laws, commonly called the *laws of nature.* On either hypothefis, effects which are produced by the regular operation of thefe laws, or which are conformable to the eftablifhed courfe of events, are properly called *natural;* and every contradiction to this conftitution of the natural fyftem, and the correfpondent courfe of events in it, is called a *miracle.*

If this definition of a miracle be juft, no event can be deemed miraculous merely becaufe it is ftrange, or even to us unaccountable; fince it may be nothing more than a regular effect of fome unknown law of nature. In this country earthquakes are rare; and for monftrous births perhaps no *particular* and fatisfactory account can be given: yet an earthquake is as regular an effect of the eftablifhed laws of nature as any of thofe with which we are moft intimately acquainted; and under circumftances in which there would always be the fame kind of production, the monfter is nature's genuine iffue. It is therefore neceffary, before we can pronounce any effect to be a true miracle, that the circumftances under which it is produced be known, and that the common courfe of nature be in fome degree underftood; for in all thofe cafes in which we are totally ignorant of nature, it is impoffible to determine what is, or what is not, a deviation from its courfe. Miracles, therefore, are not, as fome have reprefented them, appeals to our ignorance. They fuppofe fome antecedent knowledge of the courfe of nature, without which no proper judgment can be formed concerning them; though with it their reality may be fo apparent as to prevent all poffibility of a difpute.

Thus,

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Thus, were a phyſician to cure a blind man of a cataract, by anointing his eyes with a chemical preparation which we had never before ſeen, and to the nature and effects of which we are abſolute ſtrangers, the cure would undoubtedly be *wonderful;* but we could not pronounce it *miraculous*, becauſe, for any thing known to us, it might be the natural effect of the operation of the unguent on the eye. But were he to recover his patient merely by commanding him to ſee, or by anointing his eyes with ſpittle, we ſhould with the utmoſt confidence pronounce the cure to be a miracle; becauſe we know perfectly that neither the human voice nor human ſpittle have, by the eſtabliſhed conſtitution of things, any ſuch power over the diſeaſes of the eye. No one is now ignorant, that perſons apparently dead are often reſtored to their families and friends, by being treated in the manner recommended by the Humane Society. To the vulgar, and ſometimes even to men of ſcience, theſe effects appear very wonderful; but as they are known to be produced by phyſical agency, they can never be conſidered as miraculous deviations from the laws of nature. On the other hand, no one could doubt of his having witneſſed a real miracle who had ſeen a perſon that had been four days dead come alive out of his grave at the *call* of another, or who had even beheld a perſon exhibiting all the *ſymptoms* of death inſtantly reſuſcitated merely by being *deſired* to live.

Thus eaſy is it, in all caſes in which the courſe of nature is underſtood, to determine whether any particular event be really a miracle; whilſt in circumſtances where we know nothing of nature and its courſe, even a true miracle, were it performed, could not be admitted as ſuch, or carry any conviction to the mind of a philoſopher.

If miracles be effects contrary to the eſtabliſhed conſtitution of things, we are certain that they will never be performed on trivial occaſions. The conſtitution of things was eſtabliſhed by the Creator and Governor of the univerſe, and is undoubtedly the offſpring of infinite wiſdom purſuing a plan for the beſt of purpoſes. From this plan no deviation can be made but by God himſelf, or by ſome powerful being acting with his permiſſion. The plans deviſed by wiſdom are ſteady in proportion to their perfection, and the plans of infinite wiſdom muſt be abſolutely perfect. From this conſideration, ſome men have ventured to conclude, that no miracle was ever wrought, or can rationally bee xpected; but maturer reflection muſt ſoon ſatisfy us that all ſuch concluſions are haſty.

Man is unqueſtionably the principal creature in this world, and apparently the only one in it who is capable of being made acquainted with the relation in which he ſtands to his Creator. We cannot, therefore, doubt, but that ſuch of the laws of nature as extend not their operation beyond the limits of this earth were eſtabliſhed chiefly, if not ſolely, for the good of mankind; and if, in any particular circumſtances, that good can be more effectually promoted by an occaſional deviation from thoſe laws, ſuch a deviation may be reaſonably expected. Were man, in the exerciſe of his mental and corporeal powers, ſubjected to the laws of phyſical neceſſity, the circumſtances ſuppoſed would indeed never occur, and of courſe no miracle could be admitted. But ſuch is not the nature of man.

Without repeating what has been ſaid elſewhere (See METAPHYSICS, Part III. chap. v.) of neceſſity and liberty, we ſhall here take it for granted, that the relation between motives and actions is different from that between cauſe and effect in phyſics; and that, mankind have ſuch command over themſelves, as that by their voluntary conduct, they can make themſelves in a great degree either happy or miſerable. We know likewiſe from hiſtory, that, by ſome means or other, almoſt all mankind were once ſunk into the groſſeſt ignorance of the moſt important truths; that they knew not the Being by whom they were created and ſupported; that they paid divine adoration to ſtocks, ſtones, and the vileſt reptiles; and that they were ſlaves to the moſt impious, cruel, and degrading ſuperſtitions.

From this depraved ſtate it was ſurely not unworthy of the common "Father of all" to reſcue his helpleſs creatures, to enlighten their underſtandings that they might perceive what is right, and to preſent to them motives of ſufficient force to engage them in the practice of it. But the underſtandings of ignorant barbarians cannot be enlightened by arguments; becauſe of the force of ſuch arguments as regard moral ſcience they are not qualified to judge. The philoſophers of Athens and Rome inculcated, indeed, many excellent moral precepts, and they ſometimes ventured to expoſe the abſurdities of the reigning ſuperſtition: but their lectures had no influence upon the multitude; and they had themſelves imbibed ſuch erroneous notions reſpecting the attributes of the Supreme Being, and the nature of the human ſoul, and converted thoſe notions into firſt principles, of which they would not permit an examination, that even among them a thorough reformation was not to be expected from the powers of reaſoning. It is likewiſe to be obſerved, that there are many truths of the utmoſt importance to mankind, which unaſſiſted reaſon could never have diſcovered. Amongſt theſe we may confidently reckon the immortality of the ſoul, the terms upon which God will be reconciled to ſinners, and the manner in which that all-perfect Being may be acceptably worſhipped; about all of which philoſophers were in ſuch uncertainty, that, according to Plato, "Whatever is ſet right, and as it ſhould be, in the preſent evil ſtate of the world, can be ſo only by the particular interpoſition of God (A)."

An immediate revelation from Heaven, therefore, was the only method by which infinite wiſdom and perfect goodneſs could reform a bewildered and vicious race. But this revelation, at whatever time we ſuppoſe it given, muſt have been made directly either to ſome choſen individuals commiſſioned to inſtruct others, or to every man and woman for whoſe benefit it was ultimately intended. Were every perſon inſtructed in

(A) Ευ γαρ χρη ειδεναι, ὁ, τι περ αν σωθη τε και γενηται οιον δει, εν τοιαυτη καταστασει πολιτειων. Θεου μοιραν αυτο σωσαι. De repub. Lib. 6.

in the knowledge of his duty by immediate inſpiration, and were the motives to practiſe it brought home to his mind by God himſelf, human nature would be wholly changed: men would not be maſters of their own actions; they would not be moral agents, nor by conſequence be capable either of reward or of puniſhment. It remains, therefore, that if God has been graciouſly pleaſed to enlighten and reform mankind, without deſtroying that moral nature which is eſſential to virtue, he can have done it only by revealing his truth to certain choſen inſtruments, who were the immediate inſtructors of their contemporaries, and through them have been the inſtructors of ſucceeding ages.

Let us ſuppoſe this to have been actually the caſe, and conſider how thoſe inſpired teachers could communicate to others every truth which had been revealed to themſelves. They might eaſily, if it was part of their duty, deliver a ſublime ſyſtem of natural and moral ſcience, and eſtabliſh it upon the common baſis of experiment and demonſtration; but what foundation could they lay for thoſe truths which unaſſiſted reaſon cannot diſcover, and which, when they are revealed, appear to have no neceſſary relation to any thing previouſly known? To a bare affirmation that they had been immediately received from God, no rational being could be expected to aſſent. The teachers might be men of known veracity, whoſe ſimple aſſertion would be admitted as ſufficient evidence for any fact, in conformity with the laws of nature; but as every man has the evidence of his own conſciouſneſs and experience that revelations from heaven are deviations from theſe laws, an aſſertion ſo apparently extravagant would be rejected as falſe, unleſs ſupported by ſome better proof than the mere affirmation of the teacher. In this ſtate of things, we can conceive no evidence ſufficient to make ſuch doctrines be received as the truths of God, but the power of working miracles committed to him who taught them. This would, indeed, be fully adequate to the purpoſe. For if there were nothing in the doctrines themſelves impious, immoral, or contrary to truths already known, the only thing which could render the teacher's aſſertion incredible, would be its implying ſuch an intimate communion with God as is contrary to the eſtabliſhed courſe of things, by which men are left to acquire all their knowledge by the exerciſe of their own faculties.—Let us now ſuppoſe ſome of thoſe inſpired teachers to tell his countrymen, that he did not deſire them, on his *ipſe dixit*, to believe that he had any preternatural communion with the Deity, but that for the truth of his aſſertion he would give them the evidence of their own ſenſes; and after this declaration let us ſuppoſe him immediately to raiſe a perſon from the dead in their preſence, merely by calling upon him to come out of his grave. Would not the only poſſible objection to the man's veracity be removed by this miracle? and his aſſertion that he had received ſuch and ſuch doctrines from God be as fully credited, as if it related to the moſt common occurrence? Undoubtedly it would; for when ſo much preternatural *power* was viſibly communicated to this perſon, no one could have reaſon to queſtion his having received an equal portion of preternatural *knowledge*. A palpable deviation from the known laws of nature, in one inſtance, is a ſenſible proof that ſuch a deviation is poſſible in another; and in ſuch a caſe as this it is the witneſs of God to the truth of a man.

Miracles, then, under which we include prophecy, are the only direct evidence which can be given of divine inſpiration. When a religion, or any religious truth, is to be revealed from heaven, they appear to be abſolutely neceſſary to enforce its reception among men; and this is the only caſe in which we can ſuppoſe them neceſſary, or believe for a moment that they ever have been or will be performed.

The hiſtory of almoſt every religion abounds with relations of prodigies and wonders, and of the intercourſe of men with the gods; but we know of no religious ſyſtem, thoſe of the Jews and Chriſtians excepted, which appealed to miracles as the ſole evidence of its truth and divinity. The pretended miracles mentioned by Pagan hiſtorians and poets are not ſaid to have been publicly wrought to enforce the truth of a new religion contrary to the reigning idolatry. Many of them may be clearly ſhown to have been mere natural events; (ſee MAGIC). Others of them are repreſented as having been performed in ſecret on the moſt trivial occaſions, and in obſcure and fabulous ages long prior to the era of the writers by whom they are recorded. And ſuch of them as at firſt view appear to be beſt atteſted, are evidently tricks contrived for intereſted purpoſes; to flatter power, or to promote the prevailing ſuperſtitions. For theſe reaſons, as well as on account of the immoral character of the divinities by whom they are ſaid to have been wrought, they are altogether unworthy of examination, and carry in the very nature of them the completeſt proofs of falſehood and impoſture.

But the miracles recorded of Moſes and of Chriſt bear a very different character. None of them is repreſented as wrought on trivial occaſions. The writers who mention them were eye-witneſſes of the facts; which they affirm to have been performed publicly, in atteſtation of the truth of their reſpective ſyſtems. They are indeed ſo incorporated with theſe ſyſtems, that the miracles cannot be ſeparated from the doctrines; and if the miracles were not really performed, the doctrines cannot poſſibly be true. Beſides all this, they were wrought in ſupport of revelations which oppoſed all the religious ſyſtems, ſuperſtitions, and prejudices, of the age in which they were given: a circumſtance which of itſelf ſets them, in point of authority, infinitely above the Pagan prodigies, as well as the lying wonders of the Romiſh church.

It is indeed, we believe, univerſally admitted, that the miracles mentioned in the book of Exodus and in the four Goſpels, might, to thoſe who ſaw them performed, be ſufficient evidence of the divine inſpiration of Moſes and of Chriſt; but to us it may be thought that they are no evidence whatever, as we muſt believe in the miracles themſelves, if we believe in them at all, upon the bare authority of human teſtimony. Why, it has been ſometimes aſked, are not miracles wrought in all ages and countries? If the religion of Chriſt was to be of perpetual duration, every generation of men ought to have complete evidence of its truth and divinity.

To the performance of miracles in every age and in every country, perhaps the ſame objections lie as to the immediate inſpiration of every individual. Were

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those miracles universally received as such, men would be so overwhelmed with the *nature* rather than with the *force* of their authority, as hardly to remain masters of their own conduct; and in that case the very end of all miracles would be defeated by their frequency. The truth, however, seems to be, that miracles so frequently repeated would not be received as such, and of course would have *no* authority; because it would be difficult, and in many cases impossible, to distinguish them from natural events. If they recurred regularly at certain intervals, we could not prove them to be deviations from the known laws of nature, because we should have the same experience for the one series of events as for the other; for the regular succession of preternatural effects, as for the established constitution and course of things.

Be this, however, as it may, we shall take the liberty to affirm, that for the reality of the Gospel miracles we have evidence as convincing to the reflecting mind, though not so striking to vulgar apprehension, as those had who were contemporary with Christ and his apostles, and actually saw the mighty works which he performed. To the admirers of Mr Hume's philosophy this assertion will appear an extravagant paradox; but we hope to demonstrate its truth from principles which, consistently with himself, that author could not have denied. He has indeed endeavoured to prove *, that "no testimony is sufficient to establish a miracle;" and the reasoning employed for this purpose is, that "a miracle being a violation of the laws of nature, which a firm and unalterable experience has established, the proof against a miracle, from the very nature of the fact, is as entire as any argument from experience can be; whereas our experience of human veracity, which (according to him) is the sole foundation of the evidence of testimony, is far from being uniform, and can therefore never preponderate against that experience which admits of no exception." This boasted and plausible argument has with equal candour and acuteness been examined by Dr Campbell †; who justly observes, that so far is experience from being the sole foundation of the evidence of testimony, that, on the contrary, testimony is the sole foundation of by far the greater part of what Mr Hume calls firm and unalterable experience; and that if in certain circumstances we did not give an implicit faith to testimony, our knowledge of events would be confined to those which had fallen under the immediate observation of our own senses. For a short view of this celebrated controversy, in which the Christian so completely vanquishes the philosopher, see the word ABRIDGEMENT.

* *Essay on Miracles.*

† *Dissertation on Miracles.*

But though Dr Campbell has exposed the sophistry of his opponent's reasoning, and overturned the *principles* from which he reasons, we are persuaded that he might safely have joined issue with him upon those very principles. To us, at least, it appears that the testimony upon which we receive the Gospel miracles is precisely of that kind which Mr Hume has acknowledged sufficient to establish even a miracle. "No testimony (says he) is sufficient to establish a miracle, unless the testimony be of such a kind that its falsehood would be more miraculous than the fact which it endeavours to establish. When one tells me that he saw a dead man restored to life, I immediately consider with myself whether it be more probable that this person should either deceive or be deceived, or that the fact which he relates should really have happened. I weigh the one miracle against the other; and according to the superiority which I discover I pronounce my decision, and always reject the greater miracle." In this passage every reader may remark what did not escape the perspicacious eye of Dr Campbell, a strange confusion of terms: but as all miracles are equally easy to the Almighty; and as Mr Hume has elsewhere observed, that "the raising of a feather, when the wind wants ever so little of a force requisite for that purpose, is as real a miracle as the raising of a house or a ship into the air;" candour obliges us to suppose, that by talking of greater and less miracles, and of always rejecting the *greater*, he meant nothing more but that of two deviations from the known laws of nature he always rejects that which in itself is least probable.

If, then, we can show that the testimony given by the apostles and other first preachers of Christianity to the miracles of their Master would, upon the supposition that those miracles were not really performed, have been as great a deviation from the known laws of nature as the miracles themselves, the balance must be considered as evenly poised by opposite miracles; and whilst it continues so, the judgment must remain in a state of suspense. But if it shall appear, that in this case the false testimony would have been a deviation from the laws of nature less probable in itself than the miracles recorded in the Gospels, the balance will be instantly destroyed; and by Mr Hume's maxim we shall be obliged to reject the supposition of falsehood in the testimony of the apostles, and admit the miracles of Christ to have been really performed.

In this argument we need not waste time in proving that those miracles, as they are represented in the writings of the New Testament, were of such a nature, and performed before so many witnesses, that no imposition could possibly be practised on the senses of those who affirm that they were present. From every page of the Gospels this is so evident, that the philosophical adversaries of the Christian faith never suppose the apostles to have been themselves deceived, but boldly accuse them of bearing false witness. But if this accusation be well founded, their testimony itself is as great a miracle as any which they record of themselves or of their Master.

It has been shown elsewhere (see METAPHYSICS, n° 138.), that by the law of association, which is one of the laws of nature, mankind, in the very process of learning to speak, necessarily learn to speak the truth; that ideas and relations are in the mind of every man so closely associated with the words by which they are expressed in his native tongue, and in every other language of which he is master, that the one cannot be entirely separated from the other; that therefore no man can on any occasion speak falsehood without some *effort*; that by no effort can a man give consistency to an unpremeditated detail of falsehood, if it be of any length, and include a number of particulars; and that it is still less possible for several men to agree in such a detail, when at a distance from each other, and cross-questioned by their enemies.

This being the case, it follows, if the testimony of the

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the apostles to their own and their Master's miracles be false, either that they must have concerted a consistent scheme of falsehood, and agreed to publish it at every hazard; or that God, or some powerful agent appointed by him, must have dissolved all the associations formed in their minds between ideas of sense and the words of language, and arbitrarily formed new associations, all in exact conformity to each other, but all in direct contradiction to truth. One or other of these events must have taken place; because, upon the supposition of falsehood, there is no other alternative. But such a dissolution and formation of associations as the latter implies, must, to every man who shall attentively consider it, appear to be as real a miracle, and to require as great an exertion of power, as the resurrection of the dead. Nor is the supposed voluntary agreement of the apostles in a scheme of falsehood an event less miraculous. When they sat down to fabricate their pretended revelation, and to contrive a series of miracles to which they were unanimously to appeal for its truth, it is plain, since they proved successful in their daring enterprise, that they must have clearly foreseen every possible circumstance in which they could be placed, and have prepared consistent answers to every question that could be put to them by their most inveterate and most enlightened enemies; by the statesman, the lawyer, the philosopher, and the priest. That such foreknowledge as this would have been miraculous, will not surely be denied; since it forms the very attribute which we find it most difficult to allow even to God himself. It is not, however, the *only* miracle which this supposition would compel us to swallow. The very *resolution* of the apostles to propagate the belief of false miracles in support of such a religion as that which is taught in the New Testament, is as great a miracle as human imagination can easily conceive.

When they formed this design, either they must have hoped to succeed, or they must have foreseen that they should fail in their undertaking; and in either case, they *chose evil for its own sake*. They could not, if they foresaw that they should fail, look for any thing but that contempt, disgrace, and persecution, which were then the inevitable consequences of an unsuccessful endeavour to overthrow the established religion. Nor could their prospects be brighter upon the supposition of their success. As they knew themselves to be false witnesses and impious deceivers, they could have no hopes beyond the grave; and by determining to oppose all the religious systems, superstitions, and prejudices of the age in which they lived, they wilfully exposed themselves to inevitable misery in the present life, to insult and imprisonment, to stripes and death. Nor can it be said that they might look forward to power and affluence when they should, through sufferings, have converted their countrymen; for so desirous were they of obtaining nothing but *misery* as the end of their mission, that they made their own persecution a test of the truth of their doctrines. They introduced the Master from whom they pretended to have received these doctrines as telling them, that "they were sent forth as sheep in the midst of wolves; that they should be delivered up to councils, and scourged in synagogues; that they should be hated of all men for his name's sake; that the brother should deliver up the brother to death, and the father the child; and that he who took not up his cross and followed after him was not worthy of him." The very system of religion, therefore, which they invented and resolved to impose upon mankind, was so contrived, that the worldly prosperity of its first preachers, and even their exemption from persecution, was incompatible with its success. Had these clear predictions of the Author of that religion, under whom the apostles acted only as ministers, not been verified, all mankind must have instantly perceived that their pretence to inspiration was false, and that Christianity was a scandalous and impudent imposture. All this the apostles could not but foresee when they formed their plan for deluding the world. Whence it follows, that when they resolved to support their pretended revelation by an appeal to forged miracles, they wilfully, and with their eyes open, exposed themselves to inevitable misery, whether they should succeed or fail in their enterprise; and that they concerted their measures so as not to admit of a possibility of recompence to themselves, either in this life or in that which is to come. But if there be a law of nature, for the reality of which we have better evidence than we have for others, it is, that "no man can choose misery for its *own sake*," or make the acquisition of it the ultimate end of his pursuit. The existence of other laws of nature we know by testimony and our own observation of the regularity of their effects. The existence of this law is made known to us not only by these means, but also by the still clearer and more conclusive evidence of our own consciousness.

Thus, then, do miracles force themselves upon our assent in every possible view which we can take of this interesting subject. If the testimony of the first preachers of Christianity was true, the miracles recorded in the Gospel were certainly performed, and the doctrines of our religion are derived from heaven. On the other hand, if that testimony was false, either God must have miraculously effaced from the minds of those by whom it was given all the associations formed between their sensible ideas and the words of language, or he must have endowed those men with the gift of prescience, and have impelled them to fabricate a pretended revelation for the purpose of deceiving the world, and involving themselves in certain and foreseen destruction.

The power necessary to perform the one series of these miracles may, for any thing known to us, be as great as that which would be requisite for the performance of the other; and considered merely as exertions of preternatural power, they may seem to balance each other, and to hold the mind in a state of suspence. But when we take into consideration the different purposes for which these opposite and contending miracles were wrought, the balance is instantly destroyed. The miracles recorded in the Gospels, if real, were wrought in support of a revelation which, in the opinion of all by whom it is received, has brought to light many important truths which could not otherwise have been made known to men; and which, by the confession of its adversaries, contains the purest moral precepts by which the conduct of mankind was ever directed. The opposite series of miracles, if real, was performed to enable, and even

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to compel, a company of Jews, of the loweſt rank and of the narroweſt education, to fabricate, with the view of inevitable deſtruction to themſelves, a conſiſtent ſcheme of falſehood, and by an appeal to forged miracles to impoſe it upon the world as a revelation from heaven. The object of the former miracles is worthy of a God of infinite wiſdom, goodneſs, and power. The object of the latter is abſolutely inconſiſtent with wiſdom and goodneſs, which are demonſtrably attributes of that Being by whom alone miracles can be performed. Whence it follows, that the ſuppoſition of the apoſtles bearing *falſe* teſtimony to the miracles of their Maſter, implies a ſeries of deviations from the laws of nature infinitely leſs probable in themſelves than thoſe miracles: and therefore, by Mr Hume's maxim, we muſt neceſſarily reject the ſuppoſition of falſehood in the teſtimony, and admit the reality of the miracles. So true is it, that for the reality of the Goſpel-miracles we have evidence as convincing to the reflecting mind, as thoſe had who were contemporary with Chriſt and his apoſtles, and were actual witneſſes to their mighty works.

MIRANDA-DE-EBRO, a town of Spain in Old Caſtile, with a ſtrong caſtle; ſeated in a country that produces excellent wine. The town is divided into two parts by the river, over which there is a handſome bridge. W. Long. 3. 10. N. Lat. 42. 52.

MIRANDE, a town of Gaſcony in France, capital of the county of Aſtarac; ſeated on a mountain near the river Bauſe. E. Long. 0. 21. N. Lat. 42. 53.

MIRANDO-DE-DOURO, or *Duero*, a ſtrong town of Portugal, and capital of the province of Tra-los-Montes, with a biſhop's ſee. It is well fortified, and ſeated on a rock near the confluence of the river Douro and Freſna. W. Long. 5. 40. N. Lat. 41. 30.

MIRANDOLA, a town of Italy, and capital of a duchy of the ſame name, ſituated between the duchies of Mantua and Modena. It is a pretty large place, well fortified, and has alſo a ſtrong citadel and fort. It has been ſeveral times taken and retaken; the laſt time by the king of Sardinia in 1742. E. Long. 11. 5. N. Lat. 44. 52.

MIRANDULA. See PICUS.

MIREVELT (Michael Janſen), portrait-painter, was the ſon of a goldſmith, and born at Delft in 1568. His father, perceiving his early inclination for the arts, placed him at firſt with one of the Wierixes, of whom he learned to draw in crayons and to engrave. At the age of twelve he executed a print of the Samaritan woman; and not long after a figure of Judith holding the head of Holofernes. Theſe juvenile performances attracted the notice of Anthony Blockland, an hiſtorical painter of great note; and under his inſtructions Mirevelt took up the pencil. He was very ſucceſsful in his attempts at painting hiſtory; but finding portraits to be more profitable, he quitted the former by degrees, and applied himſelf to portrait painting only. His reputation, according to De Piles, was ſo great, that he exacted what price for his pictures he pleaſed, never taking leſs than 150 florins a piece. The portraits drawn and painted by this artiſt are exceedingly numerous; and many of them were excellently engraved by William James Delft, his near relation, a very ſkilful artiſt. He died in 1641.

MIREVELT (Peter), ſon of Michael, was born at Delft in 1596, and died in 1632. In his manner of deſign, in his ſtyle of colouring, and in the delicacy of his pencil, he exactly reſembled his father; and by the beſt judges of that time he was accounted to be in no degree inferior to him.

MIRIAM, ſiſter of Aaron and Moſes, makes two or three remarkable appearances in ſcripture. It was owing to her that her mother was employed by Pharaoh's daughter as nurſe to Moſes. She put herſelf at the head of the women of Iſrael after their paſſage through the Red Sea, in order to ſing the ſong which the men had ſung before. She joined with her brother Aaron in murmuring againſt Moſes, and was ſeverely chaſtiſed for that action; for ſhe became leprous, and continued ſeparate from the reſt without the camp for ſeven days. She died before her brothers, though in the ſame year with them, and was buried at the public expence.

MIRROR, a name for a looking glaſs, or any poliſhed body, whoſe uſe is to form the images of diſtant objects, by reflection of the rays of light. See REFLECTION.

Mirrors are either plain, convex, or concave. The firſt reflect the rays of light in a direction exactly ſimilar to that in which they fall upon them, and therefore repreſent bodies of their natural magnitude. The convex ones make the rays diverge much more than before reflection, and therefore greatly diminiſh the images of thoſe objects which they ſhow: while the concave ones, by collecting the rays into a focus, not only magnify the objects they ſhow, but will burn very fiercely when expoſed to the rays of the ſun; and hence they are commonly known by the name of *burning mirrors*. See *BURNING-Mirrors*.

In ancient times the mirrors were made of ſome kind of metal; and from a paſſage in the Moſaic writings we learn that the mirrors uſed by the Jewiſh women were made of braſs. The Jews certainly had been taught to uſe that kind of mirrors by the Egyptians; from whence it is probable that brazen mirrors were the firſt kind uſed in the world. Any kind of metal, indeed, when well poliſhed, will reflect very powerfully; but of all others ſilver reflects the moſt, tho' it has been in all countries too expenſive a material for common uſe. Gold alſo is very powerful; and metals, or even wood, gilded and poliſhed, will act very powerfully as burning mirrors. Even poliſhed ivory, or ſtraw nicely plaited together, will form mirrors capable of burning, if on a large ſcale.

Since the invention of glaſs, and the application of quickſilver to it, became generally known, it hath been univerſally employed for thoſe plain mirrors uſed as ornaments to houſes; but in making reflecting teleſcopes, they have been found much inferior to metallic ones. It doth not appear that the ſame ſuperiority belongs to the metalline burning mirrors, conſidered merely as burning glaſſes; ſince the mirror with which Mr Macquer melted platina, though only 22 inches diameter, and which was made of quickſilvered glaſs, produced much greater effects than M. Villette's metalline ſpeculum, which conſiderably exceeded it in ſize. It is very probable, however, that this mirror of M. Vilette's was by no means ſo well poliſhed as it ought to have been; as the art of preparing the metal for taking the fineſt poliſh has but lately been diſcovered and publiſhed in the Philoſophical Tranſactions

Mire-crow ‖ Mischna.

tions by Mr Mudge. See *Glass-Grinding*, and the *Mechanical Part* of Optics.

MIRE-CROW, sea-crow, or *Pewit*. See Larus.

MISADVENTURE, in common language, signifies any unlucky accident which takes place without being foreseen.

Misadventure, in law, has an especial signification for the killing a man partly by negligence, and partly by chance. See Homicide.

MISANTHROPY (formed μισος, *hatred*, and ανθρωπος, a *man*); a general dislike or aversion to man, and mankind. In which sense it stands opposed to *philanthropy*, or the love of mankind.

MISCARRIAGE. See Abortion and Midwifery.

MISCHNA, or Misna, (from שנה, *iteravit*), a part of the Jewish Talmud.

The Mischna contains the text; and the Gemara, which is the second part of the Talmud, contains the commentaries: so that the Gemara is, as it were, a glossary on the Mischna.

The Mischna consists of various traditions of the Jews, and of explanations of several passages of scripture: these traditions serving as an explication of the written law, and supplement to it, are said to have been delivered to Moses during the time of his abode on the Mount; which he afterwards communicated to Aaron, Eleazar, and his servant Joshua. By these they were transmitted to the 70 elders, by them to the prophets, who communicated them to the men of the great sanhedrim, from whom the wise men of Jerusalem and Babylon received them. According to Prideaux's account, they passed from Jeremiah to Baruch, from him to Ezra, and from Ezra to the men of the great synagogue, the last of whom was Simon the Just; who delivered them to Antigonus of Socho: and from him they came down in regular succession to Simeon, who took our Saviour in his arms; to Gamaliel, at whose feet Paul was educated; and last of all to Rabbi Judah the Holy, who committed them to writing in the Mischna. But Dr Prideaux, rejecting this Jewish fiction, observes, that after the death of Simeon the Just, about 299 years before Christ, the Mischnical doctors arose, who, by their comments and conclusions, added to the number of those traditions which had been received and allowed by Ezra and the men of the great synagogue; so that towards the middle of the second century after Christ, under the empire of Antoninus Pius, it was found necessary to commit these traditions to writing; more especially, as their country had considerably suffered under Adrian, and many of their schools had been dissolved, and their learned men cut off; and therefore the usual method of preserving their traditions had failed. Rabbi Judah on this occasion being rector of the school at Tiberias, and president of the sanhedrim in that place, undertook the work, and compiled it in six books, each consisting of several tracts, which altogether make up the number of 63. *Prid. Connect.* vol. ii. p. 468, &c. ed. 9. This learned author computes, that the Mischna was composed about the 150th year of our Lord; but Dr Lightfoot says, that Rabbi Judah compiled the Mischna about the year of Christ 190, in the latter end of the reign of Commodus; or, as some compute, in the year of Christ 220. Dr Lardner is of opinion, that this work could not have been finished before the year 190, or later. Collect. of Jewish and Heathen Testimonies, &c. vol. i. p. 178. Thus the book called the *Mischna* was formed; a book which the Jews have generally received with the greatest veneration. The original has been published with a Latin translation by Surenhusius, with notes of his own, and others from the learned Maimonides, &c. in 6 vols. fol. Amsterd. A. D. 1698—1703. (See Talmud). It is written in a much purer style, and is not near so full of dreams and visions as the Gemara.

Misdemeanour ‖ Misenum.

MISDEMEANOUR, in law, signifies a crime. Every crime is a misdemeanour; yet the law has made a distinction between crimes of an higher and a lower nature; the latter being denominated *misdemeanours*, the former *felonies*, &c. For the understanding of which distinction, we shall give the following definition from Blackstone's Commentaries, vol. iv. 5.

"A crime, or misdemeanour, is an act *committed* or *omitted*, in violation of a public law, either forbidding or commanding it. This general definition comprehends both *crimes* and *misdemeanours*; which, properly speaking, are mere synonymous terms; though, in common usage, the word *crime* is made to denote such offences as are of a deeper and more atrocious dye; while smaller faults, and omissions of less consequence, are comprised under the gentler name of *misdemeanours* only."

MISE, in law-books, is used in various senses: thus it sometimes signifies costs or expences; in which sense it is commonly used in entering of judgments in actions personal. It is also used for the issue to be tried on the grand assize; in which case, joining of the mise upon the mere right, is putting in issue between the tenant and demandant, Who has the best or clearest right.

Mise also signifies a tax or tallage, &c. An honorary gift, or customary present from the people of Wales to every new king or prince of Wales, anciently given in cattle, wine, and corn, but now in money, being 5000 l. or more, is denominated a *mise*: so was the usual tribute or fine of 3000 merks paid by the inhabitants of the county palatine of Chester at the change of every owner of the said earldoms, for enjoying their liberties. And at Chester they have a mise-book, wherein every town and village in the county is rated what to pay towards the mise. The 27 Hen. VIII. c. 26. ordains that lords shall have all such mises and profits of their lands as they had in times past, &c.

Mise, is sometimes also corruptly used for *mease*, in law French *mees*, "a messuage;" as a *mise place*, in some manors, is such a messuage or tenement as answers the lord a heriot at the death of its owner. 2. *Inst.* 528.

MISENUM, or Misenus, (anc. geog.); a promontory, port, and town in Campania, situated to the south-west of Baiæ, in the Sinus Puteolanus, on the north side. Here Augustus had a fleet, called *Classis Misenensis*, for guarding the Mare Inferum; as he had another at Ravenna for the Superum.

On this peninsula a villa was built by Caius Marius, with a degree of elegance that gave great offence to the more austere among the Romans, who thought

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it ill suited to the character of so rough a soldier. Upon the same foundation Lucullus, the plunderer of the eastern world, erected an edifice, in comparison of which the former house was a cottage; but even his magnificence was eclipsed by the splendour of the palace which the emperors raised upon the same spot. To these proud abodes of heroes and monarchs, which have long been levelled to the ground, a few fishing huts, as Mr Swinburn informs us, and a lonely public house, have succeeded; hither boatmen resort to tipple, perhaps on the identical site where the voluptuous masters of the world quaffed Chian and Falernian wines.

MISER, a parsimonious person who is at the same time rich; or a wretch covetous to extremity, whom avarice has divested of all the charities of human nature, and made even an enemy to himself.

Of this most unaccountable of all characters, many instances occur; some of them so extraordinary as almost to surpass belief. The following are here selected, as being of recent date, perfectly authentic, and the last of them in particular exhibiting an assemblage of qualities the most singular perhaps that ever centered in the same person. Too little dignified to merit a place in regular biography, yet too curious a variety of human character to pass unnoticed in this Work, the present seemed the only title under which it could with propriety be introduced.

1. In December 1790, died at Paris, literally of want, Mr Ostervald, a well-known banker. This man, originally of Neufchatel, felt the violence of the disease of avarice (for surely it is rather a disease than a passion of the mind) so strongly, that, within a few days of his death, no importunities could induce him to buy a few pounds of meat for the purpose of making a little soup for him. "'Tis true (said he), I should not dislike the soup, but I have no appetite for the meat; what then is to become of that?" At the time that he refused this nourishment, for fear of being obliged to give away two or three pounds of meat, there was tied round his neck a silken bag, which contained 800 assignats of 1000 livres each. At his outset in life, he drank a pint of beer, which served him for supper, every night at a house much frequented, from which he carried home all the bottle-corks he could come at. Of these, in the course of eight years, he had collected as many as sold for 12 louis-d'or, a sum that laid the foundation of his future fortune, the superstructure of which was rapidly raised by his uncommon success in stock-jobbing. He died possessed of three millions of livres (L. 125,000 sterling).

2. The late John Elwes, Esq; was member for Berkshire in three successive parliaments. His family name was *Meggot;* and his father was a brewer of great eminence, and distinguished by no peculiarity of character: but his mother, though she was left nearly L. 100,000 by her husband, starved herself to death! At an early period of life he was sent to Westminster school, where he remained for 10 or 12 years. During that time he certainly had not misapplied his talents; for he was a good classical scholar to the last: and it is a circumstance not a little remarkable, though well authenticated, that he never read afterwards, nor had he ever any knowledge in accounts; to which may in some measure be attributed the total ignorance he was always in as to his affairs. From Westminster school Mr Meggot removed to Geneva, where he soon entered upon pursuits more agreeable to him than study. The riding-master of the academy there had then to boast perhaps of three of the best riders in Europe, Mr Worsley, Mr Elwes, and Sir Sydney Meadows. Of the three, Elwes was reckoned the most desperate; the young horses were always put into his hands, and he was the rough-rider to the other two.

On his return to England, after an absence of two or three years, he was to be introduced to his uncle the late Sir Harvey Elwes, who was then living at Stoke in Suffolk, perhaps the most perfect picture of human penury that ever existed. The attempts at saving money were in him so extraordinary, that Mr Elwes perhaps never quite reached them, even at the last period of his life.—Of what temperance can do, Sir Harvey was an instance. At an early period of life he was given over for a consumption, and he lived till betwixt 80 and 90 years of age. On his death, his fortune, which was at least L. 250,000, fell to his nephew Mr Meggot, who by will was ordered to assume the name and arms of Elwes. To this uncle, and this property, Mr Elwes succeeded when he had advanced beyond the 40th year of his age. And for 15 years previous to this period, it was that he was known in the more fashionable circles of London. He had always a turn for play; and it was only late in life, and from paying always and not always being paid, that he conceived disgust at it. The theory which he professed, "that it was impossible to ask a gentleman for money," he perfectly confirmed by the practice; and he never violated this feeling to the latest hour of his life.

The manners of Mr Elwes were such—so gentle, so attentive, so gentlemanly, and so engaging—that rudeness could not ruffle them, nor strong ingratitude break their observance. He retained this peculiar feature of the old court to the last: but he had a praise beyond this; he had the most gallant disregard of his own person, and all care about himself, that can be imagined. The instances in younger life, in the most imminent personal hazard, are innumerable; but when age had despoiled him of his activity, and might have rendered care and attention about himself natural, he knew not what they were: He wished no one to assist him: "He was as young as ever; he could walk; he could ride, and he could dance; and he hoped he should not give trouble even when he was old:" He was at that time 75.

It is curious to remark how he contrived to mingle small attempts at saving with objects of the most unbounded dissipation. After sitting up a whole night at play for thousands with the most fashionable and profligate men of the time, amidst splendid rooms, gilt sofas, wax lights, and waiters attendant on his call, he would walk out about four in the morning, not towards home, but into Smithfield, to meet his own cattle, which were coming to market from Thaydon-hall, a farm of his in Essex! There would this same man, forgetful of the scenes he had just left, stand in the cold or rain bartering with a carcass-butcher for a shilling! Sometimes, when the cattle did not arrive at the hour he expected, he would walk on in the mire to meet them; and more than once has gone on foot the whole

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whole way to his farm without ſtopping, which was 17 miles from London, after ſitting up the whole night. Had every man been of the mind of Mr Elwes, the race of innkeepers muſt have periſhed, and poſt-chaiſes have been returned back to thoſe who made them; for it was the buſineſs of his life to avoid both. He always travelled on horſeback. To ſee him ſetting out on a journey, was a matter truly curious; his firſt care was to put two or three eggs, boiled hard, into his great coat pocket, or any ſcraps of bread which he found; baggage he never took: then mounting one of his hunters, his next attention was to get out of London into that road where turnpikes were the feweſt: then, ſtopping under any hedge where graſs preſented itſelf for his horſe, and a little water for himſelf, he would ſit down and refreſh himſelf and his horſe together.

The chief reſidence of Mr Elwes at this period of his life was in Berkſhire, at his own ſeat at Marcham. Here it was he had two natural ſons born, who inherit the greateſt part of his property by a will made about the year 1785. The keeping fox-hounds was the only inſtance in the whole life of Mr Elwes of his ever ſacrificing money to pleaſure; and may be ſelected as the only period when he forgot the cares, the perplexities, and the regret, which his wealth occaſioned. But even here every thing was done in the moſt frugal manner. Scrub, in the Beaux Stratagem, when compared with Mr Elwes's huntſman, had an idle life of it. This famous huntſman might have fixed an epoch in the hiſtory of ſervants: for in a morning, getting up at four o'clock, he milked the cows; he then prepared breakfaſt for Mr Elwes or any friends he might have with him; then ſlipping on a green coat, he hurried into the ſtable, ſaddled the horſes, got the hounds out of the kennel, and away they went into the field. After the fatigues of hunting, he refreſhed himſelf by rubbing down two or three horſes as quickly as he could; then running into the houſe to lay the cloth, and wait at dinner; then hurrying again into the ſtable to feed the horſes—diverſified with an interlude of the cows again to milk, the dogs to feed, and eight hunters to litter down for the night.

In the penury of Mr Elwes there was ſomething that ſeemed like a judgment from heaven. All earthly comforts he voluntarily denied himſelf: he would walk home in the rain in London rather than pay a ſhilling for a coach; he would ſit in wet cloaths ſooner than have a fire to dry them; he would eat his proviſions in the laſt ſtage of putrefaction ſooner than have a freſh joint from the butchers; and he wore a wig for above a fortnight, which his biographer* ſaw him pick up out of a rut in a lane where they were riding. This was the laſt extremity of laudable œconomy; for to all appearance it was the caſt-off wig of ſome beggar!

Mr Elwes had now reſided about 13 years in Suffolk, when the conteſt for Berkſhire preſented itſelf on the diſſolution of the parliament; and when, to preſerve the peace of that county, he was nominated by Lord Craven. Mr Elwes, though he had retired from public buſineſs for ſome years, had ſtill left about him ſome of the ſeeds of more active life, and he agreed to the propoſal. It came farther enhanced to him, by the agreement, that he was to be brought in by the freeholders for nothing. All he did on the occaſion was dining at the ordinary at Reading; and he got into parliament for 18 pence!

* Mr Top-[illegible] n; [illegible] whole [illegible] of [illegible] El- [illegible] Eſq: parti- [illegible] ars of [illegible] article [illegible] extract-

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Though a new man, Mr Elwes could not be called a young member; for he was at this time nearly 60 years old when he thus entered on public life. But he was in poſſeſſion of all his activity; and, preparatory to his appearance on the boards of St Stephen's Chapel, he uſed to attend conſtantly during the races and other public meetings all the great towns where his voters reſided. At the different aſſemblies, he would dance amongſt the youngeſt to the laſt, after riding over on horſeback, and frequently in the rain, to the place of meeting. A gentleman who was one night ſtanding by, obſerved on the extraordinary agility of ſo old a man.—"O! that is nothing (replied another); for Mr Elwes, to do this, rode 20 miles in the rain, with his ſhoes ſtuck into his boots and his bag-wig in his pocket."

The honour of parliament made no alteration in the dreſs of Mr Elwes: on the contrary, it ſeemed at this time to have attained additional meanneſs; and nearly to have reached that happy climax of poverty, which has more than once drawn on him the compaſſion of thoſe who paſſed by him in the ſtreet. For the ſpeaker's dinners, however, he had one ſuit, with which the ſpeaker in the courſe of the ſeſſions became very familiar. The miniſter likewiſe was well acquainted with it; and at any dinner of oppoſition ſtill was his apparel the ſame. The wits of the minority uſed to ſay, "that they had full as much reaſon as the miniſter to be ſatisfied with Mr Elwes, as he had the ſame habit with every body." At this period of his life Mr Elwes wore a wig. Much about the time when his parliamentary life ceaſed, that wig was worn out; ſo then, being older and wiſer as to expence, he wore his own hair, which like his expences was very ſmall.

All this time the income of Mr Elwes was increaſing hourly, and his preſent expenditure was next to nothing; for the little pleaſures he had once engaged in he had now given up. He kept no houſe, and only one old ſervant and a couple of horſes: he reſided with his nephew: his two ſons he had ſtationed in Suffolk and Berkſhire, to look after his reſpective eſtates: and his dreſs certainly was no expence to him; for had not other people been more careful than himſelf, he would not have had it even mended.

When he left London, he went on horſeback to his country-ſeats with his couple of hard eggs, and without once ſtopping upon the road at any houſe. He always took the moſt unfrequented road, and uſed every ſhift to avoid turnpikes. Marcham was the ſeat he now chiefly viſited; which had ſome reaſon to be flattered with the preference, as his journey into Suffolk coſt him only two-pence halfpenny, while that into Berkſhire amounted to four-pence!

As Mr Elwes came into parliament without expence, he performed his duty as a member would have done in the pure days of our conſtitution. What he had not bought, he never attempted to ſell; and he went forward in that ſtraight and direct path, which can alone ſatiſfy a reflecting mind. Amongſt the ſmaller memorials of the parliamentary life of Mr Elwes may be noted, that he did not follow the cu-

Miser. ftom of members in general, by fitting on any particular fide of the houfe, but fat as occafion prefented itfelf on either indifcriminately; and he voted much in the fame manner, but never rofe to fpeak. In his attendance at the houfe, he was always early and late; and he never left it for dinner, as he had accuftomed himfelf to fafting, fometimes for 24 hours in continuance.

When he quitted parliament, he was, in the common phrafe, "a fifh out of water!" The ftyle of Mr Elwes's life had left him no domeftic fcenes to which he could retire—his home was dreary and poor—his rooms received no cheerfulnefs from fire; and while the outfide had all the appearance of a "Houfe to be Let," the infide was a defert; but he had his penury alone to thank for this, and for the want of all the little confolations which fhould attend old age, and fmooth the paffage of declining life. At the clofe of the fpring of 1785, he wifhed again to vifit, which he had not done for fome years, his feat at Stoke. But then the journey was a moft ferious object to him. The famous old fervant was dead; all the horfes that remained with him were a couple of worn-out broodmares; and he himfelf was not in that vigour of body in which he could ride 60 or 70 miles on the fuftenance of *two boiled eggs*. The mention of a poft-chaife would have been a crime—"He afford a poft-chaife, indeed! where was he to get the money?" would have been his exclamation. At length he was carried into the country as he was carried into parliament, free of expence, by a gentleman who was certainly not quite fo rich as Mr Elwes. When he reached Stoke—the feat of more active fcenes, of fomewhat refembling hofpitality, and where his fox-hounds had fpread fomewhat like vivacity around—he remarked, "he had expended a great deal of money once very foolifhly; but that a man grew wifer by time."

The rooms at this feat, which were now much out of repair, and would have all fallen in but for his fon John Elwes, Efq; who had refided there, he thought too expenfively furnifhed, as worfe things might have ferved. If a window was broken, there was to be no repair but that of a little brown paper, or that of piecing in a bit of broken glafs; which had at length been done fo frequently, and in fo many fhapes, that it would have puzzled a mathematician to fay "what figure they defcribed." To fave fire, he would walk about the remains of an old greenhoufe, or fit with a fervant in the kitchen. During the harveft he would amufe himfelf with going into the fields to glean the corn on the grounds of his own tenants; and they ufed to leave a little more than common to pleafe the old gentleman, who was as eager after it as any pauper in the parifh. In the advance of the feafon, his morning employment was to pick up any ftray chips, bones, or other things, to carry to the fire, in his pocket—and he was one day furprifed by a neighbouring gentleman in the act of pulling down, with fome difficulty, a crow's neft for this purpofe. On the gentleman wondering why he gave himfelf this trouble—"Oh, Sir, (replied old Elwes), it is really a fhame that thefe creatures fhould do fo. Do but fee what wafte they make! They don't care how extravagant they are!"

As no gleam of favourite paffion, or any ray of amufement, broke through this gloom of penury, his infatiable defire of faving was now become uniform and fyftematic. He ufed ftill to ride about the country on one of thefe mares—but then he rode her very economically, on the foft turf, adjoining the road, without putting himfelf to the expence of fhoes, as he obferved, "The turf was fo pleafant to a horfe's foot!" And when any gentleman called to pay him a vifit, and the boy who attended in the ftables was profufe enough to put a little hay before his horfe, old Elwes would flily fteal back into the ftable, and take the hay very carefully away. That very ftrong appetite which Mr Elwes had in fome meafure reftrained during the long fitting of parliament, he now indulged moft voracioufly, and on every thing he could find. To fave, as he thought, the expence of going to a butcher, he would have a whole fheep killed, and fo eat mutton to the—*end of the chapter*. When he occafionally had his river drawn, though fometimes horfeloads of fmall fifh were taken, not one would he fuffer to be thrown in again; for he obferved, "He fhould never fee them again!" Game in the laft ftate of putrefaction, and meat that *walked about his plate*, would he continue to eat, rather than have new things killed before the old provifion was finifhed. With this diet—the *charnel-houfe of fuftenance*—his drefs kept pace—equally in the laft ftage of *abfolute diffolution*. Sometimes he would walk about in a tattered brown-coloured hat, and fometimes in a red and white woollen cap, like a prifoner confined for debt. His fhoes he never would fuffer to be cleaned, left they fhould be worn out the fooner. But ftill, with all this *felf-denial*—that penury of life to which the inhabitant of an *alms-houfe* is not doomed—ftill did he think he was profufe, and frequently fay, "He muft be a little more careful of his property." His difquietude on the fubject of money was now continual. When he went to bed, he would put five or ten guineas into a bureau; and then, full of his money, after he had retired to reft, and fometimes in the middle of the night, he would come down to fee if it was there.

The fcene of mortification at which Mr Elwes was now arrived was all but a denial of the common neceffaries of life: and indeed it might have admitted a doubt, whether or not, if his manors, his fifh-ponds, and fome grounds in his own hands, had not furnifhed a fubfiftence, where he had not any thing *actually to buy*, he would not, rather than have *bought any thing*, have ftarved. Strange as this may appear, it is not exaggerated.—He one day, during this period, dined upon the remaining part of a moor-hen, which had been brought out of the river by a *rat!* and at another eat an undigefted part of a pike which a larger one had fwallowed, but had not finifhed, and which were taken in this ftate in a net. At the time this laft circumftance happened, he difcovered a ftrange kind of fatisfaction; for he faid to a friend, "Aye! this was killing two birds with one ftone!" In the room of all comment—of all moral—let it be remarked, that at this time Mr Elwes was perhaps worth nearly *eight hundred thoufand pounds!* and, at this period, he had not made his will, of courfe was not faving from any fentiment of affection for any perfon.

The fummer of 1788 Mr Elwes paffed at his houfe in Welbeck-ftreet, London; and he paffed that fummer without any other fociety than that of two maid-

Miser. fervants; for he had now given up the expence of keeping any male domeftic. His chief employment ufed to be that of getting up early in a morning to vifit fome of his houfes in Mary-le-Bone, which during the fummer were repairing. As he was there generally at four o'clock in a morning, he was of courfe on the fpot before the workmen; and he ufed contentedly to fit down on the fteps before the door, to fcold them when they did come. The neighbours who ufed to fee him appear thus regular every morning, and who concluded, from his apparel, he was one of the workmen, obferved, "there never was fo punctual a man as the old carpenter." During the whole morning he would continue to run up and down ftairs to fee the men were not idle for an inftant, with the fame anxiety as if his whole happinefs in life had been centered in the finifhing this houfe, regardlefs of the greater property he had at ftake in various places, and for ever employed in the *minutiæ* only of affairs. Indeed fuch was his anxiety about this houfe, the rent of which was not above L. 50 a-year, that it brought on a fever which nearly coft him his life: but the fate which dragged him on thus ftrangely to bury him under the load of his own wealth, feemed as refiftlefs as it was unaccountable.

In the mufcular and unencumbered frame of Mr Elwes there was every thing that promifed extreme length of life; and he lived to above 70 years of age without any natural diforder attacking him: but, as Lord Bacon has well obferved, "the minds of fome men are a lamp that is continually burning;" and fuch was the mind of Mr Elwes. Removed from thofe occafional public avocations which had once engaged his attention, money was now his only thought. He rofe upon money—upon money he lay down to reft; and as his capacity funk away from him by degrees, he dwindled from the real cares of his property into the puerile concealment of a few guineas. This little ftore he would carefully wrap up in various papers, and depofiting them in different corners, would amufe himfelf with running from one to the other, to fee whether they were all fafe. Then forgetting, perhaps, where he had concealed fome of them, he would become as ferioufly afflicted as a man might be who had loft all his property. Nor was the day alone thus fpent—he would frequently rife in the middle of the night, and be heard walking about different parts of the houfe, looking after what he had thus hidden and forgotten.

During the winter of 1789, the laft winter Mr Elwes was fated to fee, his memory vifibly weakened every day; and from the unceafing wifh to fave money he now began to fear he fhould die in want of it. Mr Gibfon had been appointed his builder in the room of Mr Adams; and one day, when this gentleman waited upon him, he faid with apparent concern, "Sir, pray confider in what a wretched ftate I am; you fee in what a good houfe I am living; and here are five guineas, which is all I have at prefent; and how I fhall go on with fuch a fum of money puzzles me to death. I dare fay you thought I was rich; now you fee how it is!"

Mr George Elwes having now fettled at his feat at Marcham in Berkfhire, he was naturally defirous that, in the affiduities of his wife, his father might at length find a comfortable home. In London he was certainly moft uncomfortable: but ftill, with thefe temptations before and behind him, a journey with any expence annexed to it was infurmountable. This, however, was luckily obviated by an offer from Mr Partis, a gentleman of the law, to take him to his ancient feat in Berkfhire with his purfe perfectly whole. But there was one circumftance ftill very diftreffing—the old gentleman had now nearly worn out his laft coat, and he would not buy a new one; his fon, therefore, with a pious fraud, contrived to get Mr Partis to buy him a coat and make him a prefent of it. Thus, formerly having had a good coat, then a bad one, and at laft no coat at all, he was kind enough to accept one from a neighbour. Mifer ‖ Misfortune.

Mr Elwes carried with him into Berkfhire five guineas and a half, and half a crown. Left the mention of this fum may appear fingular, it fhould be faid, that previous to his journey he had carefully wrapped it up in various folds of paper, that no part of it might be loft. On the arrival of the old gentleman, Mr George Elwes and his wife did every thing they could to make the country a fcene of quiet to him. But "he had that within" which baffled every effort of this kind. Of his heart it might be faid, "there was no peace in Ifrael." His mind, caft away upon the vaft and troubled ocean of his property extending beyond the bounds of his calculation, returned to amufe itfelf with fetching and carrying about a few guineas, which in that ocean was indeed a drop. But nature had now carried on life nearly as far as fhe was able, and the fand was almoft run out. The firft fymptoms of more immediate decay was his inability to enjoy his reft at night. Frequently would he be heard at midnight as if ftruggling with fome one in his chamber, and crying out, "I will keep my money, I will; nobody fhall rob me of my property." On any one of the family going into his room, he would ftart from this fever of anxiety, and, as if waking from a troubled dream, again hurry into bed, and feem unconfcious of what had happened. At length, on the 26th November 1789, expired this miferably rich man, whofe property, nearly reaching to a million, extended itfelf almoft through every county in England.

MISERICORDIA, in law, is an arbitrary fine impofed on any perfon for an offence: this is called *mifericordia*, becaufe the amercement ought to be but fmall, and lefs than that required by magna charta. If a perfon be outrageoufly amerced in a court that is not of record, the writ called *moderata mifericordia* lies for moderating the amercement according to the nature of the fault.

MISFORTUNE. An unlucky accident.

Misfortune, or chance, in law, a deficiency of the will; or committing of an unlawful act by misfortune or chance, and not by defign. In fuch cafe, the will obferves a total neutrality, and does not co-operate with the deed; which therefore wants one main ingredient of a crime. See Crime.

Of this, when it affects the life of another, we have fpoken under the article Homicide; and in this place have only occafion to obferve, that if any accidental mifchief happens to follow from the performance of a lawful act, the party ftands excufed from all guilt: but

but if a man be doing any thing unlawful, and a consequence ensues which he did not foresee or intend, as the death of a man or the like, his want of foresight shall be no excuse; for, being guilty of one offence, in doing antecedently what is in itself unlawful, he is criminally guilty of whatever consequence may follow the first misbehaviour.

MISFEASANCE, in law-books, signifies a trespass.

MISLETOE, in botany. See VISCUM.

MISNOMER, in law, a misnaming or mistaking a person's name. The Christian name of a person should always be perfect; but the law is not so strict in regard to surnames, a small mistake in which will be dispensed with to make good a contract, and support the act of the party. See PLEA *to Indictment*.

MISPRISIONS, (a term derived from the old French, *mespris*, a neglect or contempt), are, in the acceptation of our law, generally understood to be all such high offences as are under the degree of capital, but nearly bordering thereon: and it is said, that a misprision is contained in every treason and felony whatsoever; and that, if the king so please, the offender may be proceeded against for the misprision only. And upon the same principle, while the jurisdiction of the star-chamber subsisted, it was held that the king might remit a prosecution for treason, and cause the delinquent to be censured in that court, merely for a high misdemeanour: as happened in the case of Roger earl of Rutland, in 43 Eliz. who was concerned in the earl of Essex's rebellion. Misprisions are generally divided into two sorts; negative, which consist in the concealment of something which ought to be revealed; and positive, which consist in the commission of something which ought not to be done.

1. Of the first, or negative kind, is what is called *misprision of treason*; consisting in the bare knowledge and concealment of treason, without any degree of assent thereto: for any assent makes the party a principal traitor; as indeed the concealment, which was construed aiding and abetting, did at the common law; in like manner as the knowledge of a plot against the state, and not revealing it, was a capital crime at Florence, and other states of Italy. But it is now enacted by the statute 1 & 2 Ph. & Mar. c. 10. that a bare concealment of treason shall be only held a misprision. This concealment becomes criminal, if the party apprised of the treason does not, as soon as conveniently may be, reveal it to some judge of assize or justice of the peace. But if there be any probable circumstances of assent, as if one goes to a treasonable meeting, knowing beforehand that a conspiracy is intended against the king; or, being in such company once by accident, and having heard such treasonable conspiracy, meets the same company again, and hears more of it, but conceals it; this is an implied assent in law, and makes the concealer guilty of actual high-treason.

Misprision of felony is also the concealment of a felony which a man knows, but never assented to; for, if he assented, this makes him either principal or accessory. And the punishment of this, in a public officer, by the statute Westm. 1. 3 Edw. I. c. 9. is imprisonment for a year and a day; in a common person, imprisonment for a less discretionary time; and, in both, fine and ransom at the king's pleasure: which pleasure of the king must be observed, once for all, not to signify any extrajudicial will of the sovereign, but such as is declared by his representatives, the judges in his courts of justice; *voluntas regis in curia, non in comera*.

2. Misprisions, which are merely positive, are generally denominated *contempt* or *high misdemeanours*; of which the principal is the *mal-administration* of such high officers as are in public trust and employment. This is usually punished by the method of parliamentary impeachment; wherein such penalties, short of death, are inflicted, as to the wisdom of the house of peers shall seem proper; consisting usually of banishment, imprisonment, fines, or perpetual disability. Hither also may be referred the offence of *embezzling the public money*, called among the Romans *peculatus*; which the Julian law punished with death in a magistrate, and with deportation, or banishment, in a private person. With us it is not a capital crime, but subjects the committer of it to a discretionary fine and imprisonment.—Other misprisions are, in general, such contempts of the executive magistrate as demonstrate themselves by some arrogant and undutiful behaviour towards the king and government: for a detail of which, *vide* Blackstone's Comment. iv. 22.

MISSAL, the Romish mass-book, containing the several masses to be said on particular days. It is derived from the Latin word *missa*, which, in the ancient Christian church, signified every part of divine service.

MISSEL-BIRD, a species of TURDUS.

MISSIO, among the Romans, was a full discharge given to a soldier after 20 years service, and differed from the *exauctoratio*, which was a discharge from duty after 17 years service. Every soldier had a right to claim his *missio* at the end of 20 years.

MISSION, in theology, denotes a power or commission to preach the gospel. Jesus Christ gave his disciples their mission in these words, *Go and teach all nations*, &c.

The Romanists reproach the Protestants, that their ministers have no mission, as not being authorised in the exercise of their ministry, either by an uninterrupted succession from the apostles, or by miracles, or by any extraordinary proof of a vocation.

Many among us deny any other mission necessary for the ministry than the talents necessary to discharge it.

MISSION is also used for an establishment of people zealous for the glory of God and the salvation of souls; who go and preach the gospel in remote countries and among infidels.

There are missions in the East as well as in the West Indies. Among the Romanists, the religious orders of St Dominic, St Francis, St Augustine, and the Jesuits, have missions in the Levant, America, &c. The Jesuits have also missions in China, and all other parts of the globe where they have been able to penetrate. There have been also several Protestant missions for diffusing the light of Christianity through the benighted regions of Asia and America. Of this kind has been the Danish mission planned by Frederic IV. in 1706. And the liberality of private benefactors in our own country has been also extended

to the support of missionaries among the Indians in America, &c.

MISSIONARY, an ecclesiastic who devotes himself and his labours to some mission, either for the instruction of the orthodox, the conviction of heretics, or the conversion of infidels. See JESUITS.

MISSISIPPI, also called the *river of St Louis*, in North America, is one of the largest in the world. Its source is unknown. It passes south through Louisiana, and runs above 2000 miles, till it falls into the gulph of Florida. Like the Nile, it has periodical inundations, by the melting of snow in the north, so that in May it overflows the country on each side, from 60 to 90 miles, and the inundation continues till near the end of July. In the lowest parts of the country there are morasses, lakes, and canals, along the banks, which are generally covered with trees, and in some places the course of the river is confined between high precipices. Its inundations always leave a great quantity of mud upon the land, and sometimes carry down trees to the river's mouth, where they form new islands, and render the entrance difficult.

MISSON (Francis Maximilian), whose pleadings before the parliament of Paris in favour of the reformers bear genuine marks of eloquence and ability, retired into England after the revocation of the edict of Nantz, and became a strenuous assertor of the Protestant religion. In the years 1687 and 1688 he travelled to Italy as governor to an English nobleman: in consequence of which he published at the Hague, "A new voyage to Italy," 3 vols 12mo; which has been translated into English with many additions. He published also the "Sacred Theatre at Cevennes, or an account of Prophecies and Miracles performed in that part of Languedoc," London 1707. "Observations and Remarks of a Traveller," 12mo, Hague. He died at London in 1721.

MISSUS, in the Circensian games, were the matches in horse or chariot races. The usual number of *missus* or matches in one day was 24; though the emperor Domitian presented the people with 100. The last match was generally made at the expence of the people, who made a collection for the purpose; hence it was called *missus ærarius*, a subscription plate.

MIST, or FOG. See FOG.

MISTAKE, any wrong action committed, not thro' an evil design, but through an error of judgement.

MISTAKE, in LAW. See IGNORANCE.

MISUSER, in law, is an abuse of any liberty or benefit; as "He shall make fine for his MISUSER." (Old. Nat. Br. 149. By misuser a charter of a corporation may be forfeited; so also an office, &c.

MISY, in natural history, a species of the chalcantha, a fossile very common in the Turkish dominions, and sometimes found in the mines of Cremnitz in Hungary. It is a considerably firm substance, of an irregular texture, not compact; much resembling some of our more gaudy marcasites, but wanting in their hardness and weight. It is of no determinate shape or size; but is often found in small detached masses, which are usually broad, flat, and very rugged at the edges. As to its medical virtues, they are no other than those of the green vitriol.

MITCHELSTOWN, a post-town of Ireland, in the county of Cork and province of Munster in Ireland, 102 miles from Dublin. Here is a college for the support of 12 decayed gentlemen and 12 decayed gentlewomen, who have L. 40 yearly, and handsome apartments, and a chaplain at L. 100 a-year, with a house: divine service is daily performed in a neat chapel belonging to the college: the whole was founded by the late earl of Kingston. Here is also a most magnificent seat of Lord Kingsborough.—Fairs are held at this town 30th July and 12th November.

MITE, a small piece of money mentioned Luke xii. 59. and xxi. 2. In the Greek it is κοδραντης, i. e. *quadrans*, or a quarter of the Roman *denarius*; so that the mite was worth about seven farthings, or two-pence of our money.

MITE, in zoology. See ACARUS.

MITELLA, BASTARD AMERICAN SANICLE: A genus of the digynia order, belonging to the decandria class of plants; and in the natural method ranking under the 13th order, *Succulentæ*. The calyx is quinquefid; the corolla pentapetalous, and inserted into the calyx; the petals pinnatifid; the capsule unilocular and bivalved, with the valves equal. There are two species, both natives of North America, rising with annual herbaceous stalks from five or six to eight or nine inches in height, and producing spikes of small whitish flowers, whose petals are fringed on their edges. They are easily propagated by parting their roots; and should be planted in a shady situation, and in a soft loamy soil.

MITHRA, feasts of, in antiquity, were feasts celebrated among the Romans in honour of Mithras or the sun. The most ancient instance of this Mithras among the Romans occurs in an inscription dated in the third consulate of Trajan, or about the year of Christ 101. This is the dedication of an altar to the sun under the above name, thus inscribed, *Deo Soli Mithræ*. But the worship of Mithras was not known in Egypt and Syria in the time of Origen, who died about the year of Christ 263; though it was common at Rome for more than a century before this time. The worship of Mithras was proscribed at Rome in the year 378, by order of Gracchus, prefect of the prætorium. According to M. Freret, the feasts of Mithras were derived from Chaldæa, where they had been instituted for celebrating the entrance of the sun into the sign Taurus.

MITHRAS, or MITHRA, a god of Persia and Chaldæa, supposed to be the sun. His worship was introduced at Rome. He is generally represented as a young man, whose head is covered with a turban after the manner of the Persians. He supports his knee upon a bull that lies on the ground, and one of whose horns he holds in one hand, while with the other he plunges a dagger in his neck.

MITHRIDATE, in pharmacy; an antidote, or composition, in form of an electuary, supposed to serve either as a remedy or a preservative against poisons. (See PHARMACY). It takes its name from the inventor, Mithridates king of Pontus; who is said to have so fortified his body against poisons with antidotes and preservatives, that when he had a mind to dispatch himself, he could not find any poison that would take effect. The receipt of it was found in his cabinet, written with his own hand, and was carried to Rome by Pompey. It was translated into

verse

Mithridates.

verse by Damocrates, a famous physician; and was afterwards translated by Galen, from whom we have it: though there is room to imagine it has undergone considerable alterations since the time of its royal prescriber.

MITHRIDATES, the name of several kings of Pontus. See PONTUS.

MITHRIDATES VII. surnamed *Eupator* and *the Great*, succeeded to the throne at the age of 11 years, about 123 years before the Christian era. The beginning of his reign was marked by ambition, cruelty, and artifice. He murdered his own mother, who had been left by his father coheiress of the kingdom; and he fortified his constitution by drinking antidotes against the poison with which his enemies at court attempted to destroy him. He early inured his body to hardship, and employed himself in the most manly exercises, often remaining whole months in the country, and making frozen snow and the earth the place of his repose. Naturally ambitious and cruel, he spared no pains to acquire himself power and dominion. He murdered the two sons whom his sister Laodice had had by Ariarathes king of Cappadocia, and placed one of his own children, only eight years old, on the vacant throne. These violent proceedings alarmed Nicomedes king of Bithynia, who had married Laodice the widow of Ariarathes. He suborned a youth to be king of Cappadocia, as the third son of Ariarathes; and Laodice was sent to Rome to impose upon the senate, and assure them that her third son was now alive, and that his pretensions to the kingdom of Cappadocia were just and well grounded. Mithridates, on his part, sent to Rome Gordius the governor of his son; who solemnly declared before the Roman people, that the youth who sat on the throne of Cappadocia was the third son and lawful heir of Ariarathes, and that he was supported as such by Mithridates. This intricate affair displeased the Roman senate; and finally to settle the dispute they took away the kingdom of Cappadocia from Mithridates, and Paphlagonia from Nicomedes. These two kingdoms being thus separated from their original possessors, were presented with their freedom and independence: but the Cappadocians refused it, and received Ariobarzanes for king. Such were the first seeds of enmity between Rome and the king of Pontus. Mithridates never lost an opportunity by which he might lessen the influence of his adversaries; and the more effectually to destroy their power in Asia, he ordered all the Romans that were in his dominions to be massacred. This was done in one night, and no less than 150,000, according to Plutarch, or 80,000 Romans, as Appian mentions, were made the victims of his cruelty. This called aloud for vengeance. Aquilius, and soon after Sylla, marched against Mithridates with a large army. The former was made prisoner; but Sylla obtained a victory over the king's generals; and another decisive engagement rendered him master of all Greece, Macedonia, Ionia, and Asia Minor. This ill fortune was aggravated by the loss of about 200,000 men, who were killed in the several engagements that had been fought; and Mithridates, weakened by repeated ill success by sea and land, sued for peace from the conqueror, which he obtained on condition of defraying the expences which the Romans had incurred by the war, and of remaining satisfied with the possessions which he had received from his ancestors. While these negociations of peace were carried on, Mithridates was not unmindful of his real interest. His poverty, and not his inclinations, obliged him to wish for peace. He immediately took the field with an army of 140,000 infantry and 16,000 horses, which consisted of his own forces and those of his son-in-law Tigranes king of Armenia. With such a numerous army, he soon made himself master of the Roman provinces in Asia; none dared to oppose his conquests; and the Romans, relying on his fidelity, had withdrawn the greatest part of their armies from the country. The news of his warlike preparations was no sooner heard, than Lucullus the consul marched into Asia; and without delay he blocked up the camp of Mithridates, who was then besieging Cyzicus. The Asiatic monarch escaped from him, and fled into the heart of his kingdom. Lucullus pursued him with the utmost celerity; and would have taken him prisoner after a battle, had not the avidity of his soldiers preferred the plundering of a mule loaded with gold to the taking of a monarch who had exercised such cruelties against their countrymen, and shown himself so faithless to the most solemn engagements. After this escape Mithridates was more careful about the safety of his person; and he even ordered his wives and sisters to destroy themselves, fearful of their falling into the enemy's hands. The appointment of Glabrio to the command of the Roman forces, instead of Lucullus, was favourable to Mithridates, who recovered the greatest part of his dominions. The sudden arrival of Pompey, however, soon put an end to his victories. A battle in the night was fought near the Euphrates, in which the troops of Pontus laboured under every disadvantage. The engagement was by moon-light, and as the moon then shone in the face of the enemy, the lengthened shadows of the arms of the Romans having induced Mithridates to believe that the two armies were close together, the arrows of his soldiers were darted from a great distance, and their efforts rendered ineffectual. An universal overthrow ensued, and Mithridates, bold in his misfortunes, rushed through the thick ranks of the enemy at the head of 800 horsemen, 500 of whom perished in the attempt to follow him. He fled to Tigranes; but that monarch refused an asylum to his father-in-law, whom he had before supported with all the collected forces of his kingdom. Mithridates found a safe retreat among the Scythians; and though destitute of power, friends, and resources, yet he meditated the overthrow of the Roman empire, by penetrating into the heart of Italy by land. These wild projects were rejected by his followers, and he sued for peace. It was denied to his ambassadors; and the victorious Pompey declared, that, to obtain it, Mithridates must ask it in person. He scorned to trust himself in the hands of his enemy, and resolved to conquer or to die. His subjects refused to follow him any longer; and revolting from him, made his son Pharnaces king. The son showed himself ungrateful to his father; and even, according to some writers, he ordered him to be put to death. This unnatural treatment broke the heart of Mithridates; he obliged his wife to poison herself, and attempted to do the same himself. It was in vain: the frequent antidotes he had taken in the

the early part of his life, strengthened his constitution against the poison; and when this was unavailing, he attempted to stab himself. The blow was not mortal; and a Gaul who was then present, at his own request gave him the fatal stroke, about 64 years before the Christian era. Such were the misfortunes, abilities, and miserable end, of a man, who supported himself so long against the power of Rome, and who, according to the declarations of the Roman authors, proved a more powerful and indefatigable adversary to the capital of Italy than the great Annibal, Pyrrhus, Perseus, or Antiochus. Mithridates has been commended for his eminent virtues, and censured for his vices. As a commander, he deserves the most unbounded applause; and it may create admiration to see him waging war, with such success, during so many years, against the most powerful people on earth, led to the field by a Sylla, a Lucullus, and a Pompey. He was the greatest monarch that ever sat on a throne, according to the opinion of Cicero; and indeed no greater proof of his military character can be brought, than the mention of the great rejoicings which happened in the Roman armies and in the capital at the news of his death. No less than 12 weeks were appointed for public thanksgivings to the immortal gods; and Pompey, who had sent the first intelligence of his death to Rome, and who had partly hastened his fall, was rewarded with the most uncommon honours. It is said that Mithridates conquered 24 nations, whose different languages he knew, and spoke with the same ease and fluency as his own. As a man of leters he also deserves attention. He was acquainted with the Greek language, and even wrote in that dialect a treatise on botany. His skill in physic is well known; and even now there is a celebrated antidote which bears his name, and is called *mithridate*. Superstition as well as nature had united to render him great; and if we rely upon the authority of Justin, his birth was accompanied by the appearance of two large comets, which were seen for 70 days successively, and whose splendor eclipsed the mid-day sun, and covered the fourth part of the heavens.

MITHRIDATICUM BELLUM, the *Mithridatic War*, one of the longest and most celebrated wars ever carried on by the Romans against a foreign power. See PONTUS.

MITRA, was a cap or covering for the head, worn by the Roman ladies, and sometimes by the men; but it was looked upon as a mark of effeminacy in the last, especially when it was tied upon their heads.

MITRE, a sacerdotal ornament worn on the head, by bishops and certain abbots on solemn occasions; being a sort of cap, pointed and cleft at top. The high-priest among the Jews wore a mitre or bonnet on his head. The inferior priests of the same nation had likewise their mitres; but in what respect they differed from that of the high-priest, is uncertain. Some contend that the ancient bishops wore mitres; but this is by no means certain.

MITRE, in architecture, is the workmens term for an angle that is just 45 degrees, or half a right one. If the angle be a quarter of a right angle, they call it a *half-mitre*.

To describe such angles, they have an instrument called the *mitre-square*; with this they strike mitre-lines on their quarters or battens; and for dispatch, they have a *mitre-box*, as they call it, which is made of two pieces of wood, each about an inch thick, one nailed upright on the edge of the other; the upper piece hath the mitre-lines struck upon it on both sides, and a kerf to direct the saw in cutting the mitre-joints readily, by only applying the piece into this box.

MITRE is used by the writers of the Irish history for a sort of base money, which was very common there about the year 1270, and for 30 years before and as many after.

There were beside the mitre several other pieces called according to the figures impressed upon them, rosaries, lionades, eagles, and by the like names. They were imported from France and other countries, and were so much below the proper currency of the kingdom, that they were not worth so much as a halfpenny each. They were at length decryed in the year 1300, and good coins struck in their place. These were the first Irish coins in which the sceptre was left out. They were struck in the reign of Edward, the son of our Henry III. and are still found among the other antiquities of that country. They have the king's head in a triangle full-faced. The penny, when well preserved, weighs 22 grains; the halfpenny $10\frac{1}{2}$ grains.

MITTAU, the capital of the duchy of Courland. It is strongly fortified; but was taken by the Swedes in 1701, and by the Muscovites in 1706. E. Long. 23. 51. N. Lat. 56. 44.

MITTIMUS, as generally used, hath two significations. 1. It signifies a writ for removing or transferring of records from one court to another. 2. It signifies a precept, or command in writing, under the hand and seal of a justice of the peace, directed to the gaoler or keeper of some prison, for the receiving and safe keeping of an offender charged with any crime, until he be delivered by due course of law.

MITYLENE, or MYTELENE (anc. geog.), a celebrated, powerful, and affluent city, capital of the island of Lesbos. It receives its name from *Mitylene*, the daughter of Macareus, a king of the country. It is greatly commended by the ancients for the stateliness of its buildings and the fruitfulness of its soil, but more particularly for the great men it produced: Pittacus, Alcæus, Sappho, Terpander, Theophanes, Hellanicus, &c. were all natives of Mitylene. It was long a seat of learning; and with Rhodes and Athens, it had the honour of having educated many of the great men of Rome and Greece. In the Peloponnesian war, the Mityleneans suffered greatly for their revolt from the power of Athens; and in the Mithridatic wars, they had the boldness to resist the Romans, and disdain the treaties which had been made between Mithridates and Sylla. See METELIN.

MIXT, or MIXT BODY, in chemistry, that which is compounded of different elements or principles.

MIXTURE, a compound or assemblage of several different bodies in the same mass. Simple mixture, consists only in the simple apposition of parts of different bodies to each other. Thus, when powders of different kinds are rubbed together, the mixture is only simple, and each of the powders retains its particular characters. In like manner, when oil and water are mixed together, though the parts of both are confounded, so that the liquor may appear to be homogeneous, we cannot say that there is any more than a simple

ſimple appoſition of the parts, as the oil and water may very eaſily be again ſeparated from each other. But the caſe is very different when bodies are *chemically* mixed; for then one or both bodies aſſume new properties, and can by no means be diſcovered in their proper form without a particular chemical proceſs adapted to this purpoſe. Hence chemical mixture is attended with many phenomena which are never obſerved in ſimple mixtures; ſuch as heat, efferveſcence, &c. To chemical mixture belongs the union of acids and alkalies, the amalgamation of metals, ſolution of gums, &c. and upon it depend many of the principal operations of CHEMISTRY. See that article *paſſim*.

MIXTURE, in pharmacy, a medicine which differs from a julep in this reſpect, that it receives into its compoſition not only ſalts, extracts, and other ſubſtances diſſoluble in water; but alſo earths, powders, and ſuch ſubſtances as cannot be diſſolved.

MIZEN, in the ſea-language, is a particular maſt or ſail. The mizen-maſt ſtands in the ſternmoſt part of the ſhip. In ſome great ſhips there are two of theſe; when that next the main-maſt is called the *main-mizen*, and that next the poop the *bonaventure mizen*.

MIZRAIM, or MISRAIM, the dual name of Egypt, uſed in ſcripture to denote the Higher and Lower Egypt, which ſee. It ſometimes occurs ſingular, *Mazor*: 2 Kings xix. Iſaiah xix. Micah vii.

MNEMOSYNE (fab. hiſt.), a daughter of Cœlus and Terra. She married Jupiter, by whom ſhe had the nine muſes. The word *mnemoſyne* ſignifies "memory;" and therefore the poets have rightly called Memory the mother of the muſes, becauſe it is to that mental endowment that mankind are indebted for their progreſs in ſcience.

MNIUM, MARSHMOSS; a genus of the natural order of muſci, belonging to the cryptogamia claſs of plants. The anthera is operculated; the calyptra ſmooth; the female capitulum naked and powdery, remote. There are 18 ſpecies, of which ſeven are natives of Britain; but none have any remarkable property except the two following. 1. The fontanum is an elegant moſs, frequent in bogs, and on the borders of cold ſprings. It is from two to four inches high: the ſtalks are ſimple at the baſe, and covered with a ruſty down; but higher up are red, and divided into ſeveral round, ſingle, taper branches, which proceed nearly from the ſame point. The leaves are not more than $\frac{1}{12}$th of an inch long, lanceolate and acute, of a whitiſh green colour; and ſo thinly ſet, that the red ſtalk appears between them. This moſs, as it may be ſeen at a conſiderable diſtance, is a good mark to lead to the diſcovery of clear and cold ſprings. Linnæus informs us, that the Laplanders are well acquainted with this ſign. Mr Withering informs us, that wherever this moſs grows, a ſpring of freſh water may be found without much digging. 2. The hygrometricum grows in woods, heaths, garden-walks, walls, old trees, decayed wood, and where coals or cinders have been laid. It is ſtemleſs, hath tips inverſely egg-ſhaped, nodding, and bright yellow. If the fruit-ſtalk is moiſtened at the baſe with a little water or ſteam, the head makes three or four revolutions: if the head is moiſtened, it turns back again.

MOAB (anc. geog.), a country of Arabia Petræa; ſo called from Moab the ſon of Lot, to whoſe poſterity this country was allotted by divine appointment, Deut. xi. 9. It was originally occupied by the Emim, a race of giants extirpated by the Moabites, *ibid.* Moab anciently lay to the ſouth of Ammon, before Sihon the Amorite ſtripped both nations of a part of their territory, afterwards occupied by the Iſraelites, Numb. xxi.; and then Moab was bounded by the river Arnon to the north, the Lacus Aſphaltites to the weſt, the brook Zared to the ſouth, and the mountains Abarim to the eaſt.

MOAT, or DITCH, in fortification, a deep trench dug round the rampart of a fortified place, to prevent ſurpriſes.

The brink of the moat, next the rampart, is called the *ſcarpe*; and the oppoſite one, the *counterſcarpe*.

A dry moat round a large place, with a ſtrong garriſon, is preferable to one full of water; becauſe the paſſage may be diſputed inch by inch, and the beſiegers, when lodged in it, are continually expoſed to the bombs, granades, and other fire-works, which are thrown inceſſantly from the rampart into their works. In the middle of dry moats, there is ſometimes another ſmall one, called *cunette*; which is generally dug ſo deep till they find water to fill it.

The deepeſt and broadeſt moats are accounted the beſt; but a deep one is preferable to a broad one: the ordinary breadth is about 20 fathoms, and the depth about 16.

To drain a moat that is full of water, they dig a trench deeper than the level of the water, to let it run off; and then throw hurdles upon the mud and ſlime, covering them with earth or bundles of ruſhes, to make a ſure and firm paſſage.

MOATAZALITES, or SEPARATISTS, a religious ſect among the Turks, who deny all forms and qualities in the Divine Being; or who diveſt God of his attributes.

There are two opinions among the Turkiſh divines concerning God. The firſt admits metaphyſical forms or attributes; as, that God has wiſdom, by which he is wiſe; power, by which he is powerful; eternity, by which he is eternal, &c. The ſecond allows God to be wiſe, powerful, eternal; but will not allow any form or quality in God, for fear of admitting a multiplicity. Thoſe who follow this latter opinion are called *Moatazalites*; they who follow the former, *Sephalites*.

The Moatazalites alſo believed that the word of God was created *in ſubjecto*, as the ſchoolmen term it, and to conſiſt of letters and ſound; copies thereof being written in books to expreſs or imitate the original; they denied abſolute predeſtination, and affirmed that man is a free agent. This ſect is ſaid to have firſt invented the ſcholaſtic divinity, and is ſubdivided into no leſs than 20 inferior ſects, which mutually brand one another with infidelity.

MOBILE, MOVEABLE, any thing ſuſceptible of motion, or that is diſpoſed to be moved either by itſelf or by ſome other prior *mobile* or mover.

Primum MOBILE, in the ancient aſtronomy, was a ninth heaven or ſphere, imagined above thoſe of the planets and fixed ſtars. This was ſuppoſed to be the

first mover, and to carry all the lower spheres round along with it; by its rapidity communicating to them a motion whereby they revolved in 24 hours. But the diurnal revolution of the planets is now accounted for without the assistance of any such *primum mobile*.

Perpetuum Mobile. See *Perpetual Motion*.

MOCHO, Moco, or *Mokha;* by some supposed to be the Musa or Muza of Ptolemy, is a port and town on the Red Sea, of considerable trade; contains about 10,000 inhabitants, Jews, Armenians, and Mohammedans; is surrounded with walls after the ancient manner; and has four gates and four towers, the last mounted with cannon; but there is no ditch. It gives name to a kingdom extending along the most southern coast of Arabia; of which that part which lies next the sea is a dry barren desart, in some places 10 or 12 leagues over; but bounded by mountains, which being well watered, enjoy an almost perpetual spring; and besides coffee, the peculiar produce of this country, yields corn, grapes, myrrh, frankincense, cassia, balm, gums of several sorts, mangos, dates, pomegranates, &c. The weather here is so hot and sultry in summer, especially when the south wind blows, that it would be insupportable, if it was not mitigated by the cool breezes that generally blow from the mountains on the north, or the Red and Arabic Seas on the west and east. The heat in winter is equal to that of our warmest summers; and it is very seldom that either clouds or rain are seen. The city of Mocho is now the emporium for the trade of all India to the Red Sea. The trade was removed hither from Aden, in consequence of the prophecy of a sheik, much revered by the people, who foretold that it would soon become a place of extensive commerce notwithstanding its disadvantageous situation. It stands close to the sea, in a large, dry, and sandy plain, that affords no good water within 20 miles of the city; what they drink comes from Mosa, and costs as dear as small-beer in England. The water near the town, as it is thought, produces a worm, which the naturalists call the *dracunculus*, which is about two feet and a half long, very slender, and breeds in the fleshy parts of the body: in extracting it great care must be used, the consequence being dangerous if any part of it remains in the body. The buildings here are lofty, and tolerably regular, having a pleasant aspect from Mecca. The steeples of several mosques are very high, presenting themselves to view at a great distance. Their markets are well stored with beef, mutton, lamb, kid, camels, and antelopes flesh, common fowls, Guinea hens, partridges, and pigeons. The sea affords plenty of fish, but not savoury; which some think proceeds from the extreme saltness of the water and the nature of their aliment. The markets are also stocked with fruit, such as grapes, peaches, apricots, quinces, and nectarines; although neither shrub nor tree is to be seen near the town, except a few date-trees. Frequently no rain falls here in two or three years, and seldom more than a shower or two in a year; but in the mountains, at the distance of about 20 miles from Mokha, the earth is watered with a gentle shower every morning, which makes the valleys fertile in corn and the fruits natural to the climate. The Arab inhabitants, though remarkably grave and superstitious, are said to be extremely covetous and hypocritical; robbing, thieving, and committing piracy, without the least scruple or remorse. The English and Dutch companies have handsome houses here, and carry on a great trade in coffee, olibanum, myrrh, aloes, liquid storax, white and yellow arsenic, gum-arabic, mummy, balm of Gilead, and other drugs. One inconvenience, however, they sustain from the violence and exactions of the Arabian princes; but the king's customs are easy, being fixed at three *per cent.* to Europeans. Of the coins at Mocha, the most current is the camassie, which rises and falls in value at the banker's discretion: they are from 50 to 80 for a current dollar, which is but an imaginary species, being always reckoned one and a half *per cent.* lower than Spanish dollars. As to their weights, they are almost infinite, according to the nature of the thing to be weighed: they have the banian weight, the magnet, the ambergris, the agala, the gold and silver weights, &c.

MOCK-ore, or *Mock-Lead*. See Blinde.

MOCKING-bird, in ornithology. See Turdus.

MOCOCO. See Lemur.

MODE, which is a word of the same general import with manner, is used as a technical term in grammar, metaphysics, and music. For its import in Grammar, see that article, n° 80.

Mode, in metaphysics, seems properly to denote the manner of a thing's existence: but Locke, whose language in that science is generally adopted, uses the word in a sense somewhat different from its ordinary and proper signification. "Such complex ideas, which, however compounded, contain not in them the supposition of subsisting by themselves, but are considered as dependencies on, or affections of, substances," he calls *modes*. Of these *modes*, there are, according to him, two sorts, which deserve distinct consideration. First, there are some "which are only variations, or different combinations of the same simple idea, without the mixture of any other, as *a dozen* or *a score*; which are nothing but the ideas of so many distinct units added together;" and these he calls *simple modes*. Secondly, "there are others compounded of simple ideas of several kinds put together to make one complex one; *v. g. beauty*, consisting of a certain composition of colour and figure, causing delight in the beholder; *theft*, which being the concealed change of the possession of any thing without the consent of the proprietor, contains, as is visible, a combination of several ideas of several kinds;" and these he calls *mixed modes*. For the just distinction between *ideas* and *notions*, as well as between *ideas* and the *qualities* of external objects, which in this account of modes are all confounded together, see Metaphysics.

Mode, in music; a regular disposition of the air and accompaniments relative to certain principal sounds upon which a piece of music is formed, and which are called the *essential sounds of the mode*.

There is this difference between the mode and the tone, that the latter only determines the principal sound, and indicates the place which is most proper to be occupied by that system which ought to constitute the bass of the air; whereas the former regulates the thirds, and modifies the whole scale agreeably to its fundamental sounds.

Our *modes* are not, like those of the ancients, characterised

Mode.

racteriſed by any ſentiment which they tend to excite, but reſult from our ſyſtem of harmony alone. The ſounds eſſential to the mode are in number three, and form together one perfect chord. 1. The tonic or key, which is the fundamental note both of the tone and of the mode: (See TONE and TONIC). 2. The dominant, which is a fifth from the tonic: (See DOMINANT). 3. The mediant, which properly conſtitutes the *mode*, and which is a third from the ſame tonic. As this third may be of two kinds, there are of conſequence two different modes. When the mediant forms a greater third with the tonic, the mode is major; when the third is leſſer, it is minor.

The major mode is immediately generated by the reſonance of ſounding bodies, which exhibit the third major of the fundamental ſound: but the minor mode is not the product of nature; it is only found by analogy and inverſion. This is equally true upon the ſyſtem of Sig. Tartini as upon that of M. Rameau.

This laſt author, in his various and ſucceſſive publications, has explained the origin of this minor mode in different ways, of which his interpreter M. d'Alembert was ſatisfied with none. It is for this reaſon that he has founded this origin on a different principle, which cannot be better explained than in the words of that eminent geometrician. See MUSIC, Art. 28, 29, 30, and 31.

When the mode is once determined, every note in the ſcale aſſumes a name expreſſive of its relation to the fundamental ſound, and peculiar to the place which it occupies in that particular mode. We ſubjoin the names of all the notes ſignificant of their relative values and places in each particular *mode*, taking the octave of *ut* as an example of the major *mode*, and of *la* as an example of the minor.

Major,	*ut*	*re*	*mi*	*fa*	*ſol*	*la*	*ſi*	*ut*,
Minor,	*la*	*ſi*	*ut*	*re*	*mi*	*fa*	*ſol*	*la*.
	Tonic.	Second note.	Mediant.	Fourth note, or Sub-dominant.	Dominant.	Sixth note, or Sub-dominant.	Seventh note.	Octave.

It is neceſſary to remark, that when the ſeventh note is only a ſemitone diſtant from the higheſt in the octave, that is to ſay, when it forms a third major with the dominant, as *ſi* natural in the major *mode*, or *ſol* ſharp in the minor, that ſeventh ſound is then called a *ſenſible note*, becauſe it diſcovers the tonic and renders the tone apreciable.

Nor does each gradation only aſſume that name which is ſuitable to it; but the nature of each interval is determined according to its relation to the *mode*. The rules eſtabliſhed for this are as follow:

1. The ſecond note muſt form a ſecond major above the tonic, the fourth note and the dominant ſhould form a fourth and fifth exactly true; and this equally in both modes.

2. In the major mode, the mediant or third, the fixth and the ſeventh from the tonic, ſhould always be major; for by this the mode is characterized. For the ſame reaſon theſe three intervals ought always to be minor in the minor mode: nevertheleſs, as it is neceſſary that the ſenſible note ſhould likewiſe there be perceived, which cannot be effectuated without a falſe relation whilſt the ſixth note ſtill remains minor; this occaſions exceptions, of which in the courſe of the air or harmony care muſt be taken. But it is always neceſſary that the cleff, with its tranſpoſitions, ſhould preſerve all the intervals, as determined with relation to the tonic, according to the ſpecies of the *mode*. For this a general rule will be found at the word *Cleff*, in Rouſſeau's Muſical Dictionary.

As all the natural chords in the octave of *ut* give, with relation to that tonic, all the intervals preſcribed for the major *mode*, and as the caſe is the ſame with the octave of *la* for the minor mode, the preceding example, which was only given that we might have an opportunity of naming the notes, may likewiſe ſerve as a formula for the rule of the intervals in each *mode*.

This rule is not, as one might imagine, eſtabliſhed upon principles that are merely arbitrary: it has its ſource in the generation of harmony, at leaſt in a certain degree. If you give a perfect major chord to the tonic, to the dominant, and the ſub-dominant, you will have all the ſounds of the diatonic ſcale for the major *mode*: to obtain that of the minor, leaving ſtill its third major to the dominant, give a third minor to the two other chords. Such is the analogy of the mode.

As this mixture of major and minor chords introduces into the minor mode a falſe relation between the fixth and the ſenſible note, to avoid this falſe relation, they ſometimes give the third major to the fourth note in aſcent, or the third minor to the dominant in deſcending, chiefly by inverting the chords; but theſe in this caſe are licences.

There are properly no more than two *modes*, as we have ſeen: but there are twelve different ſounds in the octave which may be made fundamental ſounds, and of conſequence form as many keys or tones; and as each of theſe tones are ſuſceptible of the major or minor mode, muſic may be compoſed in twenty-four modes or manners. Nay, in the manner of writing muſic, there are even thirty-four paſſable modes: but in practice ten are excluded; which when thoroughly examined are nothing elſe but a repetition of the other ten, under relations much more difficult, in which all the chords muſt change their names, and where it muſt coſt any one ſome trouble to know what he is about. Such is the major mode upon a note raiſed above its natural pitch by a ſemitone, and the minor mode upon a note depreſſed by a ſemitone. Thus, inſtead of compoſing upon *ſol* ſharp with a third major, it is much more eligible to operate upon *la* flat, which will give you an opportunity to employ the ſame tones; and inſtead of compoſing upon *re* flat with a third minor, you will find it more convenient to chooſe *ut* ſharp for the ſame reaſon; viz. on one hand to avoid a *fa* with a double ſharp, which would be equivalent to a *ſol* natural; and on the other hand a *ſi* with a double flat, which would become a *la* natural.

The compoſer does not always continue in the ſame *mode*, nor in the ſame *key*, in which he has begun an air; but, whether to alter the expreſſion or introduce variety, *modes* and *keys* are frequently changed, according to the analogy of harmony; yet always returning to thoſe which have been firſt heard: this is called *modulation*.

From

From thence arises a new division of *modes* into such as are *principal* and such as are *relative:* the principal is that in which the piece begins and ends; the relative modes are such as the composer interweaves with the principal in the flow of the harmony. (See MODULATION).

Others have proposed a third species, which they call a *mixed mode*, because it participates the modulation of both the others, or rather because it is composed of them; a mixture which they did not reckon an inconveniency, but rather an advantage, as it increases the variety, and gives the composer a greater latitude both in air and harmony.

This new mode, not being found by the analysis of the three chords like the two former, is not determined, like them, by harmonics essential to the mode, but by an entire scale which is peculiar to itself, as well in rising as descending; so that in the two modes above-mentioned the scale is investigated by the chords, and in this mixed mode the chords are investigated by the scale. The following notes exhibit the form of this scale in succession, as well rising as descending:

mi fa sol la si ut re mi.

Of which the essential difference is, as to the *melody*, in the position of the two semitones; of which the first is found between the first and the second note, and the last between the fifth and sixth; and, with respect to the *harmony*, the difference consists in this, that upon its tonic it carries a third minor in the beginning, and major in ending, in the accompaniment of this scale, as well in rising as descending, such as it has been given by those who proposed it, and executed at a spiritual concert, May 30, 1751.

They object to its inventor, That his mode has neither chords nor harmony essential to itself, nor cadences which are peculiar to it, and which sufficiently distinguish it from the major or minor mode. He answers to this, That the distinction of his mode is less in harmony than in melody, and less even in the mode itself than in the modulation; that in its beginning it is distinguished from the major mode by its third minor, and in its end from the minor mode by its plagal cadence. To which his opponents reply, That a modulation which is not exclusive cannot be sufficient to establish a mode; and that his must inevitably occur in the two other modes, and above all in the minor: and, as to his plagal cadence, that it necessarily takes place in the minor mode as often as transition is made from the chord of the tonic to that of the dominant, as has long been the case in practice, even upon final notes, in plagal modes, and in the tone proper to the fourth. From whence it is concluded, that his mixed mode is not so much a particular species, as a new denomination for the manner of interweaving and combining the major and minor modes, as ancient as harmony, practised at all periods; and this appears to be so true, that, even when he begins his scale, its author will neither venture to give the fifth nor the sixth to his tonic, for fear lest by the first the tonic should be determined in the minor mode, or the mediant in the major mode by the second. He leaves the harmony equivocal by not filling up his chord.

But whatever objections may be made against the mixed mode, whose name is rather rejected than its practice, this will not prevent the author from appearing as a man of genius, and a musician profoundly learned in the principles of his art, by the manner in which he treats it, and the arguments which he uses to establish it.

MODE *Major.*
MODE *Minor.* } See INTERVAL.

MODEL, in a general sense, an original pattern, proposed for any one to copy or imitate.

This word is particularly used, in building, for an artificial pattern made in wood, stone, plaster, or other matter, with all its parts and proportions, in order for the better conducting and executing some great work, and to give an idea of the effect it will have in large. In all great buildings, it is much the surest way to make a model in relievo, and not to trust to a bare design or draught. There are also models for the building of ships, &c. and for extraordinary staircases, &c.

They also use models in painting and sculpture; whence, in the academies, they give the term *model* to a naked man or woman, disposed in several postures, to afford an opportunity to the scholars to design him in various views and attitudes.

2 General method of making models.

Models in imitation of any natural or artificial substance, are most usually made by means of moulds composed of plaster of Paris. For the purpose of making these moulds, this kind of plaster is much more fit than any other substance, on account of the power it has of absorbing water, and soon condensing into an hard substance, even after it has been rendered so thin as to be of the consistence of cream. This happens in a shorter or longer time as the plaster is of a better or worse quality; and its good or bad properties depend very much upon its age, to which, therefore, particular regard ought to be had. It is sold in the shops at very different prices; the finest being made use of for casts, and the middling sort for moulds. It may be very easily coloured by means of almost any kind of powder excepting what contains an alkaline salt; for this would chemically decompose the substance of it, and render it unfit for use. A very considerable quantity of chalk would also render it soft and useless, but lime hardens it to a great degree. The addition of common size will likewise render it much harder than if mere water is made use of. In making either moulds or models, however, we must be careful not to make the mixture too thick at first; for if this is done, and more water added to thin it, the composition must always prove brittle and of a bad quality.

The particular manner of making models (or *casts*, as they are also called) depends on the form of the subject to be taken. The process is easy, where the parts are elevated only in a slight degree, or where they form only a right or obtuse angle with the principal surface from which they project; but where the parts project in smaller angles, or form curves inclined towards the principal surface, the work is more difficult. This observation, however, holds good only with regard to hard and inflexible bodies; for such as are soft may often be freed from the mould, even though they have the shape last mentioned. But

Model. though this be the case with the soft original substance, it is not so with the inflexible model when once it is cast.

The moulds are to be made of various degrees of thickness, according to the size of the model to be cast; and may be from half an inch to an inch, or, if very large, an inch and an half. Where a number of models are to be taken from one mould, it will likewise be necessary to have it of a stronger contexture than where only a few are required, for very obvious reasons.

3
Anatomical models.

It is much more easy to make a mould for any soft substance than a rigid one, as in any of the viscera of the animal body: for the fluidity of the mixture makes it easily accommodate itself to the projecting parts of the substance; and as it is necessary to inflate these substances, they may be very readily extracted again by letting out the air which distended them.

When a model is to be taken, the surface of the original is first to be greased, in order to prevent the plaster from sticking to it; but if the substance itself is slippery, as is the case with the internal parts of the human body, this need not be done: when necessary, it may be laid over with linseed oil by means of a painter's brush. The original is then to be laid on a smooth table, previously greased or covered with a cloth, to prevent the plaster sticking to it; then surround the original with a frame or ridge of glazier's putty, at such a distance from it as will admit the plaster to rest upon the table on all sides of the subject for about an inch, or as much as is sufficient to give the proper degree of strength to the mould. A sufficient quantity of plaster is then to be poured as uniformly as possible over the whole substance, until it be every where covered to such a thickness as to give a proper substance to the mould, which may vary in proportion to the size. The whole must then be suffered to remain in this condition till the plaster has attained its hardness; when the frame is taken away, the mould may be inverted, and the subject removed from it; and when the plaster is thoroughly dry let it be well seasoned.

Pole's Anatomical Instructor.

Having formed and seasoned the moulds, they must next be prepared for the casts by greasing the inside of them with a mixture of olive oil and lard in equal parts, and then filled with fine fluid plaster, and the plain of the mould formed by its resting on the surface of the table covered to a sufficient thickness with coarse plaster, to form a strong basis or support for the cast where this support is requisite, as is particularly the case where the thin and membranous parts of the body are to be represented. After the plaster is poured into the mould, it must be suffered to stand until it has acquired the greatest degree of hardness it will receive; after which the mould must be removed: but this will be attended with some difficulty when the shape of the subject is unfavourable; and in some cases the mould must be separated by means of a small mallet and chissel. If by these instruments any parts of the model should be broken off, they may be cemented by making the two surfaces to be applied to each other quite wet; then interposing betwixt them a little liquid plaster; and lastly, the joint smoothed after being thoroughly dry. Any small holes that may be made in the mould can be filled up with liquid plaster, after the sides of them have been thoroughly wetted, and smoothed over with the edge of a knife.

In many cases it is altogether impracticable to prepare a mould of one piece for a whole subject; and therefore it must be considered how this can be done in such a manner as to divide the mould into the fewest pieces. This may be effected by making every piece cover as much of the pattern as possible, without surrounding such projecting parts, or running into such hollows as would not admit a separation of the mould. It is impossible, however, to give any particular directions in this matter which can hold good in every instance, the number of pieces of which the mould is to consist being always determined from the shape of the pattern. Thus the mould of the human calculus will require no more than three pieces, but that of an *os femoris* could scarce have fewer than ten or twelve.—Where any internal pieces are required, they are first to be made, and then the outer pieces after the former have become hard.

To make a mould upon an hard and dry substance, we must, in the first place, rub the surface of it smoothly over with the mixture of oil and lard abovementioned. Such hollows as require internal pieces are then to be filled up with fluid plaster; and while it continues in this state, a wire loop must be introduced into it, by which, when hardened, it can be pulled off. The plaster should be somewhat raised in a pyramidal form around this wire, and afterwards cut smooth with a knife while yet in its soft state; preserving two or three angular ridges from the loop to the outer edge, that it may fix the more steadily in the outer piece of the mould to be afterwards made upon it. Let the outer piece then be well greased, to prevent the second piece from adhering; the loop being inclosed with some glazier's putty, both to prevent the second piece from adhering and to preserve an hollow place for the cord.

To form the second or outside piece, mix a quantity of plaster proportioned to the extent of surface it is to cover and the intended thickness of the mould: when it is just beginning to thicken, or assumes such a consistence as not to run off very easily, spread it over the internal piece or pieces as well as the pattern, taking care at the same time not to go too far lest it should not deliver safely; and as the plaster becomes more tenacious, add more upon the pattern until it has become sufficiently thick, keeping the edges square and smooth like the edge of a board. The plaster should be spread equally upon all parts, which is best done by a painter's pallet-knife or apothecary's bolus-knife: but for this the instrument should be somewhat less pliable than it is commonly made.

When the outside piece is hardened, the edges are to be pared smooth, and nearly made square with a small pointed knife. Little holes of a conical shape are to be made with the point of a knife about an inch distant from one another, according to the size of the piece. These are designed to receive the fluid plaster in forming the adjacent parts of the mould, and occasion points corresponding to the hollows; and are intended to preserve the edges of the different pieces steadily in their proper relative situations. The third piece is then to be formed in a manner similar to the second;

Model.

ſecond; greaſing the edges of the former plentifully with hog's lard and oil, to prevent the pieces from adhering to each other. Thus the pattern is to be wholly incloſed, only leaving a proper orifice for pouring in the plaſter to form the model; ſmall holes being alſo bored in the mould oppoſite to the wire-loops fixed in the inſide pieces, through which a cord is to be conveyed from the loop to confine ſuch pieces during the time of caſting. In ſome caſes, however, it is not neceſſary that the mould ſhould totally incloſe the pattern; for inſtance, where a model is to be made of a pedeſtal, or a buſt of any part of the human body. The bottom of ſuch moulds being left open, there is accordingly ample room for pouring in the plaſter.

After the mould is completely formed, it is next to be dried either naturally or by a gentle artificial heat, and then ſeaſoned in the following manner:—Having been made thoroughly dry, which, if the mould is large, will require two or three weeks, it is to be bruſhed over plentifully with linſeed oil boiled with ſugar of lead, finely levigated litharge, or oil of vitriol. The inſide and joints of the mould ſhould be particularly well ſupplied with it. If the mould be large, it is needleſs to attend to the outſide: but when the moulds are ſmall, it will not be improper to boil them in the oil; by which means their pores are more exactly filled than could otherwiſe be done. After the moulds have undergone this operation, they are again ſet by to dry, when, being greaſed with olive-oil and hog's lard, they are fit for uſe. If linſeed oil be uſed for greaſing the moulds, it will in a ſhort time impart a diſagreeable yellow colour to the caſts.

The mould being properly prepared and ſeaſoned, nothing more is requiſite to form the model than to pour the fineſt liquid plaſter of Paris into it. After a layer of this, about half an inch in thickneſs, has been formed all round the mould, we may uſe the coarſer kind to fill it up entirely, or to give to the model what thickneſs we pleaſe.

4 Models from living ſubjects.

Beſides the models which are taken from inanimate bodies, it has been frequently attempted to take the exact reſemblance of people while living, by uſing their face as the original of a model, from whence to take a mould; and the operation, however diſagreeable, has been ſubmitted to by perſons of the higheſt ranks in life. A conſiderable difficulty occurs in this, however, by reaſon of the perſon's being apt to ſhrink and diſtort his features when the liquid is poured upon him; neither is he altogether without danger of ſuffocation, unleſs the operator well underſtands his buſineſs.

To avoid the former inconvenience, it will be proper to mix the plaſter with warm inſtead of cold water, by which means the perſon will be under no temptation to ſhrink; and to prevent any danger of a fatal accident, the following method is to be practiſed: Having laid the perſon horizontally on his back, the head muſt firſt be raiſed by means of a pillow to the exact poſition in which it is naturally carried when the body is erect; then the parts to be repreſented muſt be very thinly covered over with fine oil of almonds by means of a painter's bruſh: the face is then to be firſt covered with fine fluid plaſter, beginning at the upper part of the fore-head, and ſpreading it over the eyes, which are to be kept cloſe, that the plaſter may not come in contact with the globe; yet not cloſed ſo ſtrongly as to cauſe any unnatural wrinkles. Cover then the noſe and ears, plugging firſt up the *meatus auditorii* with cotton, and the noſtrils with a ſmall quantity of tow rolled up, of a proper ſize, to exclude the plaſter. During the time that the noſe is thus ſtopped, the perſon is to breathe through the mouth: in this ſtate the fluid plaſter is to be brought down low enough to cover the upper lip, obſerving to leave the rolls of tow projecting out of the plaſter. When the operation is thus far carried on, the plaſter muſt be ſuffered to harden; after which the tow may be withdrawn, and the noſtrils left free and open for breathing. The mouth is then to be cloſed in its natural poſition, and the plaſter brought down to the extremity of the chin. Begin then to cover that part of the breaſt which is to be repreſented, and ſpread the plaſter to the outſides of the arms and upwards, in ſuch a manner as to meet and join that which is previouſly laid on the face: when the whole of the maſs has acquired its due hardneſs, it is to be cautiouſly lifted, without breaking or giving pain to the perſon. After the mould is conſtructed, it muſt be ſeaſoned in the manner already directed; and when the mould is caſt, it is to be ſeparated from the model by means of a ſmall mallet and chiſſel. The eyes, which are neceſſarily ſhown cloſed, are to be carved, ſo that the eye-lids may be repreſented in an elevated poſture; the noſtrils hollowed out, and the back part of the head, from which, on account of the hair, no mould can be taken, muſt be finiſhed according to the ſkill of the artiſt. The edges of the model are then to be neatly ſmoothed off, and the buſt fixed on its pedeſtal.

5 Topographical models.

The method of making models in the plaſter of Paris is undoubtedly the moſt eaſy way of obtaining them. When models, however, are made of ſuch large objects that the model itſelf muſt be of conſiderable ſize, it is vain to attempt making it in the way above deſcribed. Such models muſt be conſtructed by the hand with ſome ſoft ſubſtance, as wax, clay, putty, &c. and it being neceſſary to keep all the proportions with mathematical exactneſs, the conſtruction of a ſingle model of this kind muſt be a work of great labour and expence as well as of time. Of all thoſe which have been undertaken by human induſtry, however, perhaps the moſt remarkable is that conſtructed by General Pfiffer, to repreſent the mountainous parts of Switzerland. It is compoſed of 142 compartments, of different ſizes and forms, reſpectively numbered, and ſo artfully put together, that they can be ſeparated and replaced with the greateſt eaſe. The model itſelf is $20\frac{1}{2}$ feet long and 12 broad, and formed on a ſcale which repreſents two Engliſh miles and a quarter by an Engliſh foot; comprehending part of the cantons of Zug, Zurich, Schweitz, Underwalden, Lucerne, Berne, and a ſmall part of the mountains of Glarus; in all, an extent of country of $18\frac{1}{4}$ leagues in length and 12 in breadth. The higheſt point of the model, from the level of the centre (which is the lake of Lucerne), is about ten inches; and as the moſt elevated mountain repreſented therein riſes 1475

toiſes or 9440 feet above the lake of Lucerne, at a groſs calculation, the height of an inch in the model is about 900 feet. The whole is painted of different colours, in ſuch a manner as to repreſent objects as they exiſt in nature; and ſo exactly is this done, that not only the woods of oak, beech, pine, and other trees, are diſtinguiſhed, but even the ſtrata of the ſeveral rocks are marked, each being ſhaped upon the ſpot, and formed of granite, gravel, or ſuch other ſubſtances as compoſe the natural mountain. So minute alſo is the accuracy of the plan, that it compriſes not only all the mountains, lakes, rivers, towns, villages, and foreſts, but every cottage, bridge, torrent, road, and even every path is diſtinctly marked.

The principal material employed in the conſtruction of this extraordinary model, is a mixture of charcoal, lime, clay, a little pitch, with a thin coat of wax; and is ſo hard that it may be trod upon without any damage. It was begun in the year 1766, at which time the general was about 50 years of age, and it employed him till the month of Auguſt 1785; during all which long ſpace of time he was employed in the moſt laborious and even dangerous taſks.—He raiſed the plans with his own hands on the ſpot, took the elevation of mountains, and laid them down in their ſeveral proportions. In the proſecution of this laborious employment he was twice arreſted for a ſpy; and in the popular cantons was frequently forced to work by moon-light, in order to avoid the jealouſy of the peaſants, who imagined that their liberty would be endangered ſhould a plan of their country be taken with ſuch minute exactneſs. Being obliged frequently to remain on the tops of ſome of the Alps, where no proviſions could be procured, he took along with him a few milk-goats, who ſupplied him with nouriſhment. When any part was finiſhed, he ſent for the people reſiding near the ſpot, and deſired them to examine each mountain with accuracy, whether it correſponded, as far as the ſmallneſs of the ſcale would admit, with its natural appearance; and then, by frequently retouching, corrected the deficiencies. Even after the model was finiſhed, he continued his Alpine expeditions with the ſame ardour as ever, and with a degree of vigour that would fatigue a much younger perſon. All his elevations were taken from the level of the lake of Lucerne; which, according to M. Sauſſure, is 1408 feet above the level of the Mediterranean.

MODENA, a duchy of Italy, bounded on the ſouth by Tuſcany and the republic of Lucca, on the north by the duchy of Mantua, on the eaſt by the Bologneſe and the territories of the church, and on the weſt by the duchy of Parma; extending in length from ſouth to north about 56 Engliſh miles, and in breadth between 24 and 36, and yielding plenty of corn, wine, and fruits, with mineral waters. In ſome places alſo petroleum is ſkimmed off the ſurface of the water of deep wells made on purpoſe; and in others is found a kind of earth or tophus, which, when pulveriſed, is ſaid to be an excellent remedy againſt poiſon, fevers, dyſenteries, and hypochondriac diſorders. The country of La Salſa affords ſeveral kinds of petrifactions. The principal rivers are the Croſtolo, Secchia, and Panaro. The family of Eſté, dukes of Modena, is very ancient. They had their name from Eſté, a ſmall city in the diſtrict of Padua. In 1753, the duke was appointed imperial vicar-general, field-marſhal, and governor, of the Milaneſe during the minority of the archduke Peter Leopold, who was declared governor-general of the Auſtrian Lombardy. The duke, though a vaſſal of the empire, hath an unlimited power within his own dominions.

Modena, an ancient city, in Latin *Mutina*, which gives name to a duchy of Italy, and is its capital. It ſtands 28 miles eaſt of Parma, 44 almoſt ſouth of Mantua, and 20 weſt of Bologna; and is a pretty large and populous, but not a handſome city. It is much celebrated by Roman authors for its grandeur and opulence; but was a great ſufferer by the ſiege it underwent during the troubles of the triumvirate. It hath long been the uſual reſidence of the dukes; and is alſo the ſee of a biſhop, who is ſuffragan to the archbiſhop of Bologna. Mr Keyſler ſays, that when Decius Brutus was beſieged here by Mark Antony, Hirtius the conſul made uſe of carrier-pigeons; and that, even at this day, pigeons are trained up at Modena to carry letters and bring back anſwers. This city hath given birth to ſeveral celebrated perſons, particularly Taſſo the poet, Correggio the great painter, Sigonius the civilian and hiſtorian, da Vignola the architect, and Montecuculi the imperial general. The tutelary ſaint of it is named *Geminianus*. The ducal palace is a very noble edifice, in which, among the other fine pictures, the birth of Chriſt by Correggio, called *la Notte Felice*, is much celebrated. The only manufacture for which this city is noted, is that of maſks, of which great numbers are exported. The churches of the Jeſuits, of the Theatines, and of St Dominic, are well worth viewing. In the college of St Carlo Boromeo between 70 and 80 young noblemen are continually maintained, and inſtructed both in the ſciences and genteel exerciſes. St Beatrix, who was of the family of Eſté, is ſaid to knock always at the gate of the palace three days before any of the family dies. Before moſt of the houſes are covered walks or porticos, as at Bologna. The city is fortified, and on its ſouth ſide ſtands the citadel.

MODERATION, in ethics, is a virtue conſiſting in the proper government of our appetites, paſſions, and purſuits, with reſpect to honours, riches, and pleaſures; and in this ſenſe it is ſynonymous with *temperance*: it is alſo often uſed to denote *candour*.

MODERATOR, in the ſchools, the perſon who preſides at a diſpute, or in a public aſſembly: thus the preſident of the annual aſſembly of the church of Scotland is ſtyled *moderator*.

MODERN, ſomething new, or of our time; in oppoſition to what is antique or *ancient*.

Modern Authors, according to Naude, are all thoſe who have wrote ſince Boethius. The modern philoſophy commences with Galileo; the modern aſtronomy with Copernicus.

MODESTY, in ethics, is ſometimes uſed to denote humility; and ſometimes to expreſs chaſtity, or purity of ſentiments and manners.—Modeſty, in this laſt ſenſe, and as particularly applied to women, is defined by the authors of the *Encyclopédie Methodique*, as a natural, chary, and honeſt ſhame; a ſecret fear; a feeling

feeling on account of what may be accompanied with disgrace. Women who possess only the remains of a suspicious modesty, make but feeble efforts to resist: those who have obliterated every trace of modesty from their countenance, soon extinguish it completely in their soul, and throw aside for ever the veil of decency. She, on the contrary, who truly possesses modesty, passes over in silence attempts against her honour, and forbears speaking of those from whom she has received an outrage, when in doing so she must reveal actions and expressions that might give alarm to virtue.

The idea of modesty is not a chimera, a popular prejudice, or an illusion arising from laws and education. Nature, which speaks the same language to all men, has, with the unanimous consent of nations, annexed contempt to female incontinence. To resist and to attack are laws of her appointment: and while she bestows desires on both parties, they are in the one accompanied with boldness, in the other with shame. To individuals she has allotted long spaces of time for the purposes of self-preservation, and but moments for the propagation of their species. What arms more gentle than *Modesty* could she have put into the hands of that sex which she designed to make resistance!

If it were the custom for both sexes to make and receive advances indiscriminately, vain importunity would not be prevented: the fire of passion would never be stirred up, but languish in tedious liberty; the most amiable of all feelings would scarcely warm the human breast; its object would with difficulty be attained. That obstacle which seems to remove this object to a distance, in fact brings it nearer. The veil of shame only makes the desires more attractive. Modesty kindles that flame which it endeavours to suppress: its fears, its evasions, its caution, its timid avowals, its pleasing and affecting finesses, speak more plainly what it wishes to conceal, than passion can do without it: it is MODESTY, in short, which enhances the value of a favour, and mitigates the pain of a refusal.

Since modesty is the secret fear of ignominy; and since all nations, ancient or modern, have confessed the obligation of its laws; it must be absurd to violate them in the punishment of crimes, which should always have for its object the re-establishment of order. Was it the intention of those oriental nations, who exposed women to elephants, trained for an abominable species of punishment, to violate one law by the observance of another? By an ancient practice among the Romans, a girl could not be put to death before she was marriageable. Tiberius found means to evade this law by ordering them to be violated by the executioner previous to the infliction of punishment; the refinement of a cruel tyrant, who sacrificed the morals to the customs of his people! When the legislature of Japan caused women be exposed naked in the market-places, and obliged them to walk on all-fours like brutes, modesty was shocked: but when it wanted to force a mother—when it wanted to compel a son—nature received an outrage.

Such is the influence of climate in other countries, that the physical part of love possesses an almost irresistible force. The resistance is feeble; the attack is accompanied with a certainty of success. This is the case at Patana, at Bantam, and in the small kingdoms on the coast of Guinea. When the women in these countries (says Mr Smith) meet with a man, they lay hold of him, and threaten to inform their husbands if he despises their favours. But here the sexes seem to have abolished the laws peculiar to each. It is fortunate to live in a temperate climate like ours, where that sex which possesses the most powerful charms exerts them to embellish society; and where modest women, while they reserve themselves for the pleasures of one, contribute to the amusement of all.

MODIFICATION, in philosophy, that which modifies a thing, or gives it this or that manner of being. Quantity and quality are accidents which modify all bodies.

Decree of MODIFICATION, in Scots law, a decree ascertaining the extent of a minister's stipend, without proportioning it among the persons liable in payment.

MODILLIONS, in architecture, ornaments in the corniche of the Ionic, Corinthian, and Composite columns.

MODIUS, a Roman dry measure for all sorts of grain, containing 32 heminæ, or 16 sextarii, or one-third of the amphora, amounting to an English peck. See MEASURE.

MODREVIUS (Andreas Frichius), secretary to Sigismund Augustus king of Poland, acquired considerable reputation by his learning and works. He broke off from the Romish church, favoured the Lutherans and Anti-trinitarians, and took great pains in order to unite all Christian societies under the same communion. Grotius has placed him in the class of the reconcilers of the different schemes of religion. His principal work is intitled, *De republica emendanda*.

MODULATION, the art of forming any thing to certain proportion.

MODULATION, in reading, or speaking. See READING.

MODULATION, in music, derived from the Latin *modulari*. This word in our language is susceptible of several different significations. It frequently means no more than an air, or a number of musical sounds properly connected and arranged. Thus it answers to what Mr Malcolm understands by the word *tune*, when he does not expressly treat concerning the tuning of instruments. Thus likewise it expresses the French word *chant*; for which reason, in the article MUSIC, we have frequently expressed the one word by the other. But the precise and technical acceptation to which it ought to be confined, is the art of composing melody or harmony agreeably to the laws prescribed by any particular key, that of changing the key, or of regularly and legitimately passing from one key to another. In what remains to be said upon the subject we follow Rousseau.

Modulation (says he) is properly the manner of ascertaining and managing the modes; but at this time the word most frequently signifies the art of conducting the harmony and the air successively through several modes, in a manner agreeable to the ear and conformed to rules.

If the different modes be produced by harmony, from thence likewise must spring the laws of modulations.

Modulation.

tion. These laws are simple in conception, but difficult in practice. We proceed therefore to show in what they consist.

To modulate properly in the same tone, it is necessary, 1. To run through all the sounds of it in an agreeable air, frequently repeating the sounds which are most essential to it, and dwelling upon these sounds with the most remarkable emphasis; that is to say, that the chord containing the sensible notes, and that of the tonic, should frequently be heard in it, but under different appearances, and obtained by different procedures to prevent monotony. 2. That reposes or cadences should only be established upon these two chords: the greatest liberty, however, which ought to be taken with the rule is, that a cadence or repose may be established on the chord of the subdominant. 3. In short, that none of the sounds of the mode ought ever to be altered; for without quitting it we cannot introduce a sharp or a flat which does not belong to it, nor abstract any one which in reality does belong to it.

But passing from one mode to another, we must consult analogy, we must consider the relations which a key bears to the other notes in the series, and to the number of sounds common to both the modes, that from whence we pass, and that into which we enter.

If we pass from a mode major, whether we consider the fifth from the key as having the most simple relation with it except that of the octave, or whether we consider it as the first sound which enters into the harmonics of the same key, we shall always find, that this fifth, which is the dominant of the mode, is the chord upon which we may establish the modulation most analogous to that of the principal key.

This dominant, which constituted one of the harmonics of the first key, makes also one of its own peculiar key, of which it is the fundamental sound. There is then a connection between these two chords. Besides, that same dominant carrying, as well as the tonic, a perfect chord major upon the principle of resonance, these two chords are only different one from the other by the dissonance, which passing from the key to the dominant is the sixth superadded, and when reascending from the dominant to the key is the seventh. Now these two chords, thus distinguished by the dissonance which is suitable to each, by the sounds which compose them when ranged in order, form precisely the octave, or the diatonic scale, which we call a *gammut*, which determines the mode.

This same series of the key, altered only by a sharp, forms the scale belonging to the mode of the dominant; which shows how striking the analogy is between these two tones, and gives the easiest opportunity of passing from one to the other by means of one single alteration alone. The mode then of the dominant is the first which presents itself after that of the key in the order of modulations.

The same simplicity of relations which we find between a tonic and its dominant, is likewise found between the same tonic and its sub-dominant: for that fifth, in ascending, which is formed by the dominant with the tonic, is likewise formed by the sub-dominant in descending: but that sub-dominant does not form a fifth with the tonic, except by inversion; it is directly a fourth, if we take that tonic below, as it ought to be; and which fixes the degree of their relations: for in this sense the fourth, whose ratio is as 3 to 4, immediately follows the fifth, whose ratio is as 2 to 3. So that, if that sub-dominant does not enter into the chord of the tonic, in return the tonic enters into its perfect chord. For let *ut mi sol* be the chord of the tonic, that of the sub-dominant shall be *fa la ut:* thus it is the *ut* which here forms the connection, and the two other sounds of this new chord, are exactly the two dissonances of the preceding. Besides, we need not alter more sounds for this new mode than for that of the dominant; they are both in the one and the other quite the same chords of the principal mode, except one. Add a flat to the sensible note *si* or B, and all the notes in the mode of *ut* or C will serve for that of *fa* or F. The mode of the sub-dominant then is scarcely less analogous to the principal mode than that of the dominant.

It ought likewise to be remarked, that after having made use of the first modulation in order to pass from a principal mode *ut* or C, to that of the dominant *sol* or G, we are obliged to make use of the second to return to the principal mode: for if *sol* or G be the dominant in the mode of *ut* or C, *ut* is the sub-dominant in the mode of *sol:* thus one of these modulations is no less necessary than the other.

The third sound which enters into the chord of the tonic is that of third formed by its mediant; and, after the preceding, it is likewise the most simple of relations $\frac{2}{3}\frac{3}{4}\frac{4}{5}$. Here then is a new modulation which presents itself, and which is so much the more analogous, because two of the sounds of the principal tonic enter likewise into the minor chord of its mediant: for the former chord being *ut mi sol*, the latter must be *mi sol si*, where it may be perceived that *mi* and *sol* are common. But what renders this modulation a little more remote, is the number of sounds which are necessary to be altered, even for the minor mode, which is most suitable to this *mi*. In the article Music (234.) will be found a table for all the modes; and Rousseau, in his Musical Dictionary, has given the formula of a scale both for the major and minor: now, by applying this formula to the minor mode, we find nothing in reality, but the fourth sound *fa* heightened by a sharp in ascending; but in rising, we find two others which are altered, *viz.* the principal tonic *ut*, and its second *re*, which here becomes a sensible note: it is certain that the alteration of so many sounds, and particularly of the tonic, must remove the mode and weaken the analogy.

If we should invert the third as we have inverted the fifth, and take that third below the tonic on the sixth note *la*, which ought here to be called a *sub-mediant*, or the *mediant below*, we shall form upon this note *la* a modulation more analogous to the principal tone than that of *mi;* for as the perfect chord of this sub-mediant is *la ut mi*, there once more we find, as in that of the mediant, two of the sounds which enter into the chord of the tonic, viz. *ut* and *mi*: and moreover, since the scale of this new key is composed, at least in descending, of the same sounds with that of the principal key; and since it has only two sounds altered in ascending, that is to say, one fewer than the series of the

the mediant; it follows that the modulation of this fixth note is preferable to that of the mediant; and by fo much the more, that there the principal tonic forms one of the founds effential to the mode; which is more proper for approximating the idea of the modulation. The *mi* may afterwards follow.

Here then are four founds, *mi fa fol la*, upon each of which we may modulate in paffing from the major mode of *ut*. *Re* and *fi* remain, which are the two harmonics of the dominant. This laft, as being a fenfible note, cannot become a tonic by any proper modulation, at leaft it cannot immediately become one: this would be an abrupt application of ideas too much oppofed to the fame founds, and would likewife be to give it a harmony too remote from the principal found. As to the fecond note *re*, we may likewife, by favour of a confonant procedure in the fundamental bafe, modulate upon it in a third minor; but this muft be only continued for an inftant, that the audience may not have time to forget the modulation of *ut*, which is itfelf altered in that place; otherwife, inftead of returning immediately to *ut*, we muft pafs through intermediate modes, where we muft run great hazard of deviation.

By following the fame analogies, we may modulate in the following order, to make our exit from a minor mode; firft upon the mediant, afterwards the dominant, next the fub-dominant, then the fub-mediant, or fixth note. The mode of each of thefe acceffory keys is determined by its mediant taken from the principal found. For inftance, iffuing from the major mode of *ut*, to modulate upon its mediant, we render the mode of that mediant minor; becaufe *fol*, the dominant of the principal found, forms a third minor with that mediant, which is *mi*. On the contrary, in our egrefs from the minor mode of *la*, we modulate upon its mediant *ut* in the major mode; becaufe *mi*, the dominant of the tone from whence we iffue, forms a third major with the key of that into which we enter, &c.

Thefe rules, comprehended in one general formula, import, that the modes of the dominant and of the fub-dominant are like that of the tonic, and that the mediant and the fixth note require a mode oppofed. We muft, however, remark, that, by the right which we have of paffing from the major to the minor, and *vice verfa*, upon the fame key, we may likewife change the order of modes from one key to another; but whilft we thus remove ourfelves from the natural modulation, we muft prefently think of our return: for it is a general rule, that every piece of mufic ought to terminate in that key with which it began.

In his Mufical Dictionary, plate B, fig. 6. and 7. Rouffeau has collected in two examples, which are very fhort, all the modes to which we may immediately pafs; the firft, in paffing from the major mode; and the fecond, from the minor. Each note indicates a particular modulation; and the value of the notes in each example likewife fhows the relative duration fuitable to each of thefe modes, according to its relation with the principal mode.

Thefe immediate tranfitions from one mode to another, furnifh us with the means of paffing by the fame rules to modes ftill more remote, and from thence to return to the principal mode, of which we never fhould lofe fight. But it is not fufficient to know what courfe we ought to purfue; we muft likewife be acquainted with the method of entering into it. A fummary therefore of the precepts which are given in this department fhall immediately follow.

In melody, in order to difcover and introduce the modulation which we have chofen, nothing is neceffary but to render perceptible the alterations which it caufes in the founds of that mode from whence we iffue, to make them proper for the mode into which we enter. Are we now in the major mode of *ut*? there needs no more than to found the note *fa* fharp, that we may difcover the mode of the dominant; or a *fi* flat, that we may fhow the mode of the fub-dominant. Afterwards you may run over the founds effential to the mode in which you enter; if it is well chofen, your modulation will always be juft and regular.

In harmony, the difficulty is a little increafed: for as it is neceffary that the change of modes fhould be made at the fame time through all the parts, care muft be taken of the harmony, and of the air, that we may avoid purfuing different modulations at the fame time. Huygens has happily remarked, that the prohibition of two fifths in immediate fucceffion proceeds upon this rule as its principle: in reality, between two parts it is fcarcely poffible to form a number of juft fifths in uninterrupted fucceffion without operating in two different modes.

To introduce a mode, a great many pretend that it is fufficient to form the perfect chord of its principal found, and this is indifpenfable in order to produce the mode. But it is certain, that the mode cannot be exactly determined but by the chord containing the fenfible note, or the dominant: we muft then caufe this chord to be heard when we enter into a new modulation. The moft eligible rule would be, That in it the feventh, or minor diffonance, fhould always be prepared, at leaft the firft time in which it is heard: but this method is not practicable in every admiffible modulation; and provided that the fundamental bafis proceeds by confonant intervals, that the connection of harmony be obferved, the analogy of the mode purfued, and falfe relations avoided, the modulation will always be approved. Compofers prefcribe as another rule, That a mode fhould not be changed except after a perfect cadence: but this interdict is ufelefs, and no perfon obferves it.

All the poffible methods of paffing from one mode to another, are reducible to five with refpect to the major mode, and to four with refpect to the minor; which, in the Mufical Dictionary, plate B, fig. 8. will be found implied in a fundamental bafis intended for each modulation. If there be any other modulation which cannot be refolved into fome one of thefe nine, unlefs that modulation be enharmonic, it muft infallibly be illegitimate. See Enharmonic.

MODULE, in architecture, a certain meafure, or bignefs, taken at pleafure, for regulating the proportions of columns, and the fymmetry or difpofition of the whole building. Architects generally choofe the femidiameter of the bottom of the column for their module, and this they fubdivide into parts or minutes.

MOEBIUS (Godfrey), profeffor of phyfic at Iena, was

was born at Lauch in Thuringia in 1611. He became firſt phyſician to Frederic William elector of Brandenburg, to Auguſtus duke of Saxony, and to William duke of Saxe-Weimar. He wrote ſeveral medical works, which are eſteemed; and died at Halle, in Saxony, in 1664.

MOENIUS (Caius), a celebrated Roman conſul, conqueror of the ancient Latins, 338 B. C. He was the firſt who hung up the prows, &c. of the galleys he had taken at the naval engagement of Actium, upon the place where the tribunes harangued the people; from whence it was called the *roſtra*.

MŒONIA, or Mæonia. See Mæonia and Lydia.

MŒSIA, or Mysia, (anc. geog.) a country of Europe, extending from the confluence of the Savus and the Danube to the ſhores of the Euxine. It was divided into Upper and Lower Mœſia. Lower Mœſia was on the borders of the Euxine, and comprehended that tract of country which received the name of *Pontus* from its vicinity to the ſea. Upper Mœſia lay beyond the other, in the inland country.

MOFFAT, a village of Scotland, in the ſhire of Annandale, 50 miles ſouth-weſt of Edinburgh; famous for its ſulphureous well, which has been in juſt eſtimation for near 150 years as a remedy in all cutaneous and ſcrophulous complaints; and for its chalybeate ſpring, perhaps the ſtrongeſt in Britain, which was diſcovered about 45 years ago, and is of a very bracing quality.—The place is chiefly ſupported by the company who reſort thither for the benefit of its waters and air; but it has alſo a manufacture of coarſe woollen ſtuffs. It is a well-built clean village; and contains many good and even elegant lodgings, a tolerable aſſembly-room, a bowling-green and walks, and one of the beſt inns between London and Edinburgh.

MOFFETTA. See Ampsancti.

MOGODORE, or Mogadore, a large, uniform, and well-built town in the kingdom of Morocco, ſituated about 350 miles from Tangier on the Atlantic ocean, and ſurrounded on the land-ſide by deep and heavy ſands. The European factory here conſiſts of about a dozen mercantile houſes of different nations, whoſe owners, from the protection granted them by the emperor, live in full ſecurity from the Moors, whom indeed they keep at a rigid diſtance. They export, to America, mules; to Europe, Morocco leather, hides, gum arabic, gum ſandaric, oſtrich feathers, copper, wax, wool, elephant's teeth, fine mats, beautiful carpeting, dates, figs, raiſins, olives, almonds, oil, &c. In return, they import timber, artillery of all kinds, gunpowder, woollen cloths, linens, lead, iron in bars, all kinds of hardware and trinkets, ſuch as looking-glaſſes, ſnuff-boxes, watches, ſmall knives, &c. tea, ſugar, ſpices, and moſt of the uſeful articles which are not otherwiſe to be procured in this empire. The town is regularly fortified on the ſea-ſide; and on the land, batteries are ſo placed as to prevent any incurſion from the ſouthern Arabs, who are of a turbulent diſpoſition, and who, from the great wealth which is known to be always in Mogodore, would gladly avail themſelves of any opportunity that offered to pillage the town. The entrance, both by ſea and land, conſiſts of elegant ſtone arch-ways, with double gates. The market-place is handſomely built, with piazzas of the ſame materials; and at the water-port there is a cuſtomhouſe and powder magazine, both of which are neat ſtone buildings. Beſides theſe public edifices, the emperor has a ſmall but handſome palace for his occaſional reſidence. The ſtreets of the town, though very narrow, are all in ſtraight lines; and the houſes, contrary to what we meet with in the other towns of the empire, are lofty and regular. The bay, which is little better than a road, and is very much expoſed when the wind is at north-weſt, is formed by a curve in the land, and a ſmall iſland about a quarter of a mile from the ſhore.—Its entrance is defended by a fort well furniſhed with guns.

MOGULS, a celebrated nation of Aſia, whoſe conqueſts formerly were the moſt rapid and extenſive of any people recorded in hiſtory. They themſelves deduce their origin from Japhet, or, as they call him, *Japhis*, the ſon of Noah. His ſon Turk, they ſay, was the firſt king, or khan, of thoſe nations who are now known by the ſeparate names of *Turks*, *Tartars*, and *Moguls*; and the Tartars eſpecially, aſſert that their proper deſignation is *Turks*. To this prince is attributed many of thoſe inventions which barbarous nations commonly aſcribe to their firſt ſovereigns. He was ſucceeded by Taunak; in whoſe reign the whole poſterity of Turk were divided into four large tribes, denominated the *orda's* of Erlat, Gialair, Kaugin, Berlas or Perlas; of which laſt came the famous Timur Beg, or Tamerlane.—From this time to that of Alanza Khan, we meet with nothing remarkable. In his reign the Turks being immerſed in all kinds of luxury, univerſally apoſtatized into idolatry. Having two ſons, Tartar and Mogul, he divided his dominions among them, and thus gave riſe to the two empires of the Tartars and Moguls.

1 Moguls deſcended from Japhet.

The two nations had not long exiſted before they began to make war upon each other: and after long contention, the event at laſt was, that Il Khan, emperor of the Moguls, was totally overthrown by Siuntz Khan, emperor of the Tartars; and ſo great was the defeat, that the Mogul nation ſeems to have been almoſt exterminated. Only two of Il Khan's family ſurvived this diſaſter. Theſe were Kajan his youngeſt ſon, and Nagos his nephew, who were both of an age, and had both been married the ſame year. Theſe two princes, with their wives, had been taken priſoners by Siuntz Khan, but found means to make their eſcape to their own country. Here they ſeized upon all the cattle which had not been carried off by the Tartars; which was eaſily done, as having none to diſpute the property with them; then ſtripping ſome of the ſlain, they took their clothes, and retired into the mountains. They paſſed ſeveral mountains without much difficulty; but at laſt advanced to the foot of one exceedingly high, which had no way over it but a very ſmall path made by certain animals, called in the Tartar language *archara*. This path they found themſelves obliged to make uſe of, though it was ſo ſtrait, that only one could paſs at a time, and he was in the moſt imminent danger of breaking his neck at the leaſt falſe ſtep.

2 Almoſt exterminated.

3 …y ar- …in a de- …tful …ey.

Having aſcended the mountain on one ſide by this path, they deſcended by the ſame on the other ſide; and were agreeably ſurpriſed to find themſelves in a moſt delightful track, interſperſed with rivulets and charming meadows, abounding with a vaſt variety of delicious fruits, and incloſed on all ſides by inacceſſible mountains, in ſuch a manner as to ſhelter them from all future purſuits of the Tartars. Here they lived ſome time, and gave this beautiful country the name of *Irgana-kon*, in alluſion to its ſituation; *Irgana* ſignifying, in the old language of the Moguls, a "valley," and *Kon* a "ſteep height."

In proceſs of time theſe two families very much increaſed. Kajan, whoſe poſterity was the moſt numerous, called his deſcendants *Kajath*: but the people ſpringing from Nagos were divided into two tribes; one of which received the appellation of *Nagoſler*, and the other that of *Durlagan*.

Theſe two Mogul princes and their deſcendants lived in this place for more than 400 years; but the latter then finding it too narrow for them, meditated a return to the country from which their forefathers had been driven. For ſome time, however, they found this impracticable, as the path that conducted their anceſtors had been long ſince deſtroyed. At laſt they diſcovered, that one part of the high mountain abovementioned was not very thick in a certain place; and alſo, that it conſiſted entirely of iron-ore. To this, having before ſet fire to a layer of wood, and another of charcoal, laid along the foot of the mountain, they applied 70 large bellows, and at laſt melted the mountain in ſuch a manner, that an opening was made large enough for a loaded camel to paſs; and through this paſſage they all marched out with great joy.

4 …m …ence …y at laſt …e, and …at the …tars.

The Moguls having thus iſſued as it were from a new world, overthrew the Tartars in their turn; and continued to be a very conſiderable nation till the time of their great hero Temujin, afterwards called *Jenghiz Khan*, whom they extol in the moſt extravagant manner. It is difficult, however, to ſay, at the time Temujin made his appearance, how far the dominions of the Moguls extended, or in what eſtimation they were held by their neighbours. It ſeems to be pretty certain, that great part of the vaſt region now known by the name of *Tartary*, was then in a ſtate of conſiderable civilization, and likewiſe extremely populous, as we find mention made of many cities which the Moguls deſtroyed; and the incredible multitudes whom they ſlaughtered, abundantly ſhow the populouſneſs of the country.

5 …e of A- …t the …; of …hiz …n.

On the eaſt, the country of the Moguls and Tartars had the great deſart which divides Tartary from China; on the weſt, it had the empire of Karazm, founded by Mahmud Gazni; and on the ſouth were the countries now known by the name of *Indoſtan*, *Siam*, *Pegu*, *Tonquin*, and *Cochin-China*. Thus it comprehended the eaſtern part of modern Tartary, and all Siberia. This whole region was divided among a great number of *Aymacks*, or *tribes*; who had each one or more khans, according as it was more or leſs numerous, or divided into branches. Among theſe, that of the *Kara-its* was the moſt powerful: their prince aſſumed the title of *Grand Khan*, and among the reſt the Moguls were tributary to him; but, according to the Chineſe hiſtorians, both the one and the other were tributary to the emperor of Kitay or Katay. China was divided into two parts: the nine ſouthern provinces were in the hands of the Chineſe emperors of the Song dynaſty, who kept their court at Hang-chew, the capital of the province of Chekyang; the five northern provinces, excepting part of Shenſi, were poſſeſſed by the Kin, a people of Eaſtern Tartary, from whom are deſcended the Manchew Tartars, at preſent maſters of China. This vaſt dominion was named *Kitay* or *Katay*, and was divided into two parts: that which belonged to China, was properly called *Kitay*; and the part which belonged to Tartary was called *Karakitay*, in which ſome even include the territories of the Moguls, Karaits, and other tribes, which are the ſubject of the preſent hiſtory. The weſtern part of the empire of Kitay was poſſeſſed by a Turkiſh prince, who had lately founded a new kingdom there, called *Hya*; whoſe capital city was Hya-chew, now Ninghya in Shenſi, from whence the kingdom took its name. To the weſt of Hya lay Tangut; a country of great extent, and formerly very powerful; but at that time reduced to a low ſtate, and divided among many princes; ſome of whom were ſubject to the emperor of Hya, and others to the emperor of China. All Tartary to the weſtward, as far as the Caſpian ſea, with the greater part of Little Buckharia, which then paſſed under the general name of *Turkeſtan*, was ſubject to Ghurkhan, Khurkhan, or Kavar Khan; to whom even the Gazni monarchs are ſaid to have been tributary. This Ghurkhan had been prince of the Weſtern Kitan or Lyau; who, driven out of Kitay by the king, ſettled in Little Buckharia, and the country to the north, where they founded a powerful ſtate about the year 1124.

6 Deſcent and birth of Temujin.

Thus the Moguls, properly ſo called, had but a very ſmall extent of empire which could be called their own, if indeed they had any, when Temujin made his appearance. This hero is ſaid by the Tartars to have been of divine origin, ſince his family could be traced no farther back than ten generations, the mother of whom was got with child by a ſpirit. The names and tranſactions of his predeceſſors are equally uncertain and unimportant: he himſelf, however, was born in the year 1163, and is ſaid to have come into the world with congealed blood in his hands; from whence it was prognoſticated that he would be a great warrior, and obtain the victory over all his enemies.

This prediction, if any ſuch there was, Temujin moſt literally fulfilled. At the time of his father's deceaſe, his ſubjects amounted to between 30,000 and 40,000 families; but of theſe two thirds quickly deſerted, and Temujin was left almoſt without ſubjects. When only 13 years of age, he fought a bloody battle againſt theſe revolters; but either was defeated, or gained an indeciſive victory; ſo that he remained in obſcurity for 27 years longer.

7 Subdues his revolted ſubjects by means of Vang Khan.

His good fortune at laſt he owed to the friendſhip of Vang Khan, who ruled over a great number of Tartar tribes to the north of Kitay, and has been heard of under the name of *Preſter John* among the Europeans. This prince took Temujin under his protection; and a rebellion being afterwards raiſed againſt himſelf, Temujin was made his general, and the khan was kept in poſſeſſion of his throne; ſoon after which, Temujin ſubdued the tribes which had revolted from himſelf, treating them at the ſame time with the utmoſt barbarity.

 This

Moguls.

8 Who becomes jealous, and contrives his destruction.

This happened in the year 1201; but Vang Khan, inftead of continuing the friend of Temujin, now became jealous, and refolved to deftroy him by treachery. With this view he propofed a marriage between Temujin's fon Juji and his own daughter, and another between Temujin's daughter and his own fon. Temujin was invited to the camp of Vang Khan, in order to celebrate this double marriage; but, receiving intelligence of fome evil intention againft him, he excufed himfelf to Vang Khan's meffengers, and defired that the ceremony might be put off to fome other time.

A few days after the departure of thefe meffengers, Badu and Kifhlik, two brothers, who kept the horfes of one of Vang Khan's chief domeftics, came and informed Temujin, that the grand Khan finding he had miffed his aim, was refolved to fet out inftantly, and furprife him next morning, before he could fufpect any danger. Temujin, alarmed at this intelligence, quitted his camp in the night-time, and retired with all his people to fome diftance. He was fcarce gone when Vang Khan's troops arrived, and difcharged an incredible number of arrows among the empty tents; but finding nobody there, they purfued Temujin in fuch hafte that they fell into great diforder. In this condition they were fuddenly attacked and routed by Temujin; after which an open war with Vang Khan took place.

9 Temujin overcomes all his enemies.

By this quarrel almoft all the princes of Tartary were put in motion, fome fiding with Temujin, and others with Vang Khan. But at laft fortune declared in favour of the former: Vang Khan was overthrown in a battle, where he loft 40,000 men; and obliged to fly for refuge to a prince named *Tayyan Khan*, who was Temujin's father-in-law, and his own enemy, and by whom he was ungeneroufly put to death. Temujin immediately began to feize on his dominions, great part of which voluntarily fubmitted: but a confederacy was formed againft him by a number of Vang Khan's tributaries, at the head of whom was Jamuka, a prince who had already diftinguifhed himfelf by his enmity to Temujin; and even Tayyan Khan himfelf was drawn into the plot, through jealoufy of his fon-in-law's good fortune. But Temujin was well prepared; and in the year 1204 attacked Tayyan Khan, entirely routed his army, killed himfelf, and took Jemuka prifoner, whofe head he caufed inftantly to be ftruck off; after which he marched againft the other tribes who had confpired againft him. Them he quickly reduced; took a city called *Kafhin*, where he put all to the fword who had borne arms againft him; and reduced all the Mogul tribes in 1205.

Temujin now, having none to oppofe him, called a general diet, which he appointed to be held on the firft day of the fpring 1206; that is, on the day in which the fun entered Aries. To this diet were fummoned all the great lords both Moguls and Tartars; and in the mean time, to eftablifh good order in the army, he divided his foldiers into bodies of 10,000, 1000, 100, and 10 men, with their refpective officers, all fubordinate to the generals, or thofe who commanded the bodies of 10,000; and thefe were to act under his own fons. On the day of holding the diet, the princes of the blood and great lords appeared dreffed in white. Temujin, dreffed in the fame manner, with his crown on his head, fat down on his throne, and was complimented by the whole affembly, who wifhed him the continuance of his health and profperity. After this they confirmed the Mogul empire to him and his fucceffors, adding all thofe kingdoms which he had fubdued, the defcendants of whofe vanquifhed khans were deprived of all right or title to them; and after this he was proclaimed emperor with much ceremony. During this inauguration, a pretended prophet declared that he came from God to tell the affembly, that from thenceforth Temujin fhould affume the name of *Jenghiz Khan*, or *the Moft Great Khan of khans*; prophecying alfo, that all his pofterity fhould be khans from generation to generation. This prophecy, which was no doubt owing to Temujin himfelf, had a furprifing effect on his fubjects, who from that time concluded that all the world belonged of right to them, and even thought it a crime againft heaven for any body to pretend to refift them.

10 Affumes the title Jenghiz Khan.

Jenghiz Khan having now reduced under his fubjection all the wandering tribes of Moguls and Tartars, began to think of reducing thofe countries to the fouth and fouth weft of his own, where the inhabitants were much more civilized than his own fubjects; and the countries being full of fortified cities, he muft of courfe expect to meet with more refiftance. He began with the emperor of Hya, whofe dominions he invaded in 1209, who at laft fubmitted to become his tributary. But in the mean time Jenghiz Khan himfelf was fuppofed to be tributary to the emperor of Kitay; who, in 1210, fent him an officer, demanding the cuftomary tribute. This was refufed with the utmoft indignation, and a war commenced, which ended not but with the diffolution of the empire of Kitay, as mentioned under the article China.

11 Invades Hya, China, &c.

In the year 1216, Jenghiz Khan refolved to carry his arms weftward, and therefore left his general Muchuli to purfue his conquefts in Kitay. In his journey weftward he overthrew an army of 300,000 Tartars who had revolted againft him; and, in 1218, fent ambaffadors defiring an alliance with Mohammed Karazm Shah, emperor of Gazna. His ambaffador was haughtily treated: however, the alliance was concluded; but foon after broken, through the treachery, as it is faid, of the Karazmian monarch's fubjects. This brought on a war attended with the moft dreadful devaftations, and which ended with the entire deftruction of the empire of Karazm or Gazna, as related under the article Gazna.

After the reduction of Karazm, part of the Moguls broke into Iran or Perfia, where alfo they made large conquefts, while others of their armies invaded Georgia and the countries to the weft; all this time committing fuch enormities, that the Chinefe hiftorians fay both men and fpirits burft with indignation. In 1225, Jenghiz Khan returned to Hya, where he made war on the emperor for having fheltered fome of his enemies. The event was, that the emperor was flain, and his kingdom conquered, or rather deftroyed; which, however, was the laft exploit of this moft cruel conqueror, who died in 1227, as he marched to complete the deftruction of the Chinefe.

12 Vaft e[xtent] of his [em]pire.

The Mogul empire, at the death of Jenghiz Khan, extended over a prodigious tract of country; being more than 1800 leagues in length from eaft to weft, and upwards of 1000 in breadth from north to fouth.

Moguls.

Its princes, however, were ſtill inſatiable, and puſhed on their conqueſts on all ſides. Oktay was acknowledged emperor after Jenghiz Khan; and had under his immediate government Moguleſtan (the country of the Moguls properly ſo called), Kitay, and the countries eaſtward to the Tartarian ſea. Jagaty his brother governed under him a great part of the weſtern conqueſts. The country of the Kipjacks, and others to the eaſt and north-eaſt, north and north-weſt, were governed by Batu or Patu the ſon of Juji, who had been killed in the wars; while Tuli or Toley, another ſon of Jenghiz Khan, had Khoraſſan, Perſia, and what part of India was conquered. On the eaſt ſide the Mogul arms were ſtill attended with ſucceſs; not only the empire of Kitay, but the ſouthern part of CHINA, was conquered, as already related under that article, n° 24—42. On the weſt ſide matters continued much in the ſame way till the year 1254, when Magu, or Menkho, the fourth khan of the Moguls, (the ſame who was afterwards killed at a ſiege in China*), raiſed a great army, which he gave to his brother Hulaku, or Hulagu, to extend his dominions weſtward. In 1255 he entered Iran, where he ſuppreſſed the Iſmaelians or Aſſaſſins, of whom an account is given under the article ASSASSINS; and two years afterwards he advanced to Bagdad, which he took, and cruelly put the khalif to death, treating the city with no more lenity than the Moguls uſually treated thoſe which fell into their hands. Every thing was put to fire and ſword; and in the city and its neighbourhood the number of ſlain, it is ſaid, amounted to 1,600,000. The next year he invaded Syria; the city of Damaſcus was delivered up, and, as it made no reſiſtance, the inhabitants were ſpared; but Aleppo being taken by ſtorm, a greater ſlaughter enſued there than had taken place at Bagdat, not even the children in their cradles being ſpared. Some cities of this country revolted the next year, or the year after; but falling again into the hands of the Moguls, they were plundered, and the inhabitants butchered without mercy, or carried into ſlavery.

* See *China*, n° 38.

13
Bagdad reduced.

Hulaku died in 1264, and at his death we may fix the greateſt extent of the Mogul empire. It now comprehended the whole of the continent of Aſia, excepting part of Indoſtan, Siam, Pegu, Cochinchina, and a few of the countries of Leſſer Aſia, which had not been attacked by them; and during all theſe vaſt conqueſts no Mogul army had ever been conquered, except one by Jaloloddin, as mentioned under the article GAZNA.—From this period, however, the empire began to decline. The ambition of the khans having prompted them to invade the kingdoms of Japan and Cochinchina, they were miſerably diſappointed in their attempts, and loſt a great number of men. The ſame bad ſucceſs attended them in Indoſtan; and in a ſhort time this mighty empire broke into ſeveral ſmaller ones. The governors of Perſia being of the family of Jenghiz Khan, owned no allegiance to any ſuperior; thoſe of Tartary did the ſame. The Chineſe threw off the yoke; and thus the continent of Aſia wore much the ſame face that it had done before Jenghiz Khan began his conqueſts.

14
Begins to decline.

The ſucceſſors of Hulaku reigned in Perſia till the year 1335; but that year Abuſaid Khan, the eighth from Hulaku, dying, the affairs of that country fell into confuſion for want of a prince of the race of Jenghiz Khan to ſucceed to the throne. The empire, therefore, was divided among a great number of petty princes, who fought againſt each other almoſt without intermiſſion, till, in the year 1369, Timur Bek, or Tamerlane, one of theſe princes, having conquered a number of others, was crowned at Balkh, with the pompous title of *Saheb Karan*; that is, "the emperor of the age, and conqueror of the world." As he had juſt before taken that city, and deſtroyed one of his moſt formidable rivals who had ſhut himſelf up in it, the new emperor began his reign with beheading ſome of the inhabitants, impriſoning others, burning their houſes, and ſelling the women and children for ſlaves. In 1370 he croſſed the Sihun, made war on the Getes, and attacked Karazm. Next year he granted a peace to his enemies; but two years after, he again invaded the country of the Getes, and by the year 1379 had fully conquered that country as well as Korazan; and from that time he continued to extend his conqueſts in much the ſame manner as Jenghiz Khan had done, though with leſs cruelty.—In 1387 he had reduced Armenia, Georgia, and all Perſia; the conqueſt of which laſt was completed by the reduction of Iſpahan, 70,000 of the inhabitants of which were ſlaughtered on account of a ſedition raiſed by ſome raſh or evil diſpoſed perſons.

15
Tamerlane crowned emperor of Balkh.

16
Becomes a great conqueror.

After the reduction of Perſia, Timur turned his arms northward and weſtward, ſubduing all the countries to the Euphrates. He took the city of Bagdad; ſubdued Syria; and having ravaged great part of Ruſſia, returned to Perſia in 1396, where he ſplendidly feaſted his whole army. In 1398 he invaded Indoſtan, croſſed the Indus on the 17th of September, reduced ſeveral fortreſſes, and made a vaſt number of captives. However, as he was afraid that, in caſe of any emergency, theſe priſoners might take part with the enemy, he gave orders to his ſoldiers to put all their Indian ſlaves to death; and, in conſequence of this inhuman order, more than 100,000 of theſe poor wretches were ſlaughtered in leſs than an hour.

17
Invades and conquers Indoſtan.

In the beginning of the year 1399, Timur was met by the Indian army; whom, after a deſperate battle, he defeated with great ſlaughter, and ſoon after took the city of Dehli, the capital of the country. Here he ſeated himſelf on the throne of the Indian emperors, and here the ſharifs, kadis, and principal inhabitants of the city, came to make their ſubmiſſion, and begged for mercy. The tame elephants and rhinoceroſes likewiſe were brought to kneel before him as they had been accuſtomed to do to the Indian emperors, and made a great cry as if they implored his clemency. Theſe war-elephants, 120 in number, were, at his return, ſent to Samarcand, and to the province where his ſons reſided. After this, at the requeſt of the lords of the court, Timur made a great feaſt; at which he diſtributed preſents to the princes and principal officers.

Dehli at this time conſiſted of three cities, called *Seyri*, *Old Dehli*, and *Jehan Penah*. Seyri was ſurrounded with a wall in form of a circle. Old Dehli was the ſame, but much larger, lying ſouth-weſt of the other. Theſe two parts were joined on each ſide by a wall; and the third, lying between them, was called *Jehan Penah*, which was larger than Old Dehli. Pe-

18
The city of Dehli deſtroyed, and the inhabitants ſlaughtered.

nah

nah had ten gates; Seyri had seven, three of which looked towards Jehan Penah; this last had thirteen gates, six to the north-west, and seven to the south-east. Every thing seemed to be in a quiet posture; when, on the 12th of January 1399, the soldiers of Timur being assembled at one of the gates of Dehli, insulted the inhabitants of the suburbs. The great emirs were ordered to put a stop to these disorders; but their endeavours were not effectual. The soltanas having a curiosity to see the rarities of Dehli, and particularly a famous palace adorned with 1000 pillars, built by an ancient king of India, went in with all the court; and the gate being on that occasion left open for every body, above 15,000 soldiers got in unperceived. But there was a far greater number of troops in a large place between Dehli, Seyri, and Jehan Penah, who committed great disorders in the two last cities. This made the inhabitants in despair fall on them; and many, setting fire to their houses, burnt their wives and children. The soldiers seeing this confusion, did nothing but pillage the houses; while the disorder was increased by the admission of more troops, who seized the inhabitants of the neighbouring places who had fled thither for shelter. The emirs, to put a stop to this mischief, caused the gates to be shut: but they were quickly opened by the soldiers within, who rose in arms against their officers; so that by the morning of the 13th the whole army was entered, and this great city was totally destroyed. Some soldiers carried out 150 slaves, men, women, and children; nay, some of their boys had 20 slaves a-piece to their share. The other spoils, in jewels, plate, and manufactures, were immense; for the Indian women and girls were adorned with precious stones, and had bracelets and rings on their hands, feet, and even toes, so that the soldiers were loaded with them. On the 15th, in Old Dehli, the Indians retired into the great mosque to defend themselves; but being attacked by the Tartars, they were all slaughtered, and towers erected with their heads. A dreadful carnage now ensued throughout the whole city, and several days were employed before the inhabitants could be made to quit it entirely; and as they went, the emirs took a number of them for their service. The artisans were also distributed among the princes and commanders; all but the masons, who were reserved for the emperor, in order to build him a spacious stone-mosque at Samarcand.

After this terrible devastation, Timur marched into the different provinces of Indostan, every where defeating the Indians who opposed him, and slaughtering the Ghebrs or worshippers of fire. On the 25th of March he set out on his return, and on the 9th of May arrived at Samarcand. In a few months after his arrival, he was obliged to undertake an expedition into Persia, where affairs were in the utmost disorder on account of the misconduct of his son, whom he had appointed sovereign of that empire. Here Timur soon settled matters; after which he again set out on

19 Timur quarrels with Bajazet the Turkish sultan.

an expedition westward, reduced many places in Georgia which had not submitted before, and invaded and conquered Syria. At the same time he quarrelled with Bajazet the Turkish sultan, then busied in an enterprise against Constantinople, in which he would probably have succeeded had not Timur interposed. The cause of this quarrel at first was, that Bajazet had demanded tribute from a prince who was under Timur's protection, and is said to have returned an insulting answer to the Tartar ambassadors who were sent to him on that account. Timur, however, who was an enthusiast in the cause of Mahometanism, and considered Bajazet as engaged in the cause of heaven when besieging a Christian city, was very unwilling to disturb him in so pious a work; and therefore undertook several expeditions against the princes of Syria and Georgia, in order to give the Turkish monarch time to cool and return to reason. Among other places, he again invested the city of Bagdad, which had cast off its allegiance to him; and having taken it by storm, made such a dreadful massacre of the inhabitants, that 120 towers were erected with the heads of the slain. In the mean time Bajazet continued to give fresh provocation, by protecting one Kara Yusef a robber, who had even insulted the caravan of Mecca; so that Timur at length resolved to make war upon him. The sultan, however, foreseeing the danger of bringing such a formidable enemy against himself, thought proper to ask pardon, by a letter, for what was past, and promise obedience to Timur's will for the future. This embassy was graciously received; and Timur returned for answer, that he would forbear hostilities, provided Bajazet would either put Kara Yusef to death, send him to the Tartar camp, or expel him out of his dominions. Along with the Turkish ambassadors he sent one of his own; telling Bajazet that he would march into the confines of Anatolia, and there wait his final answer.

Though Bajazet had seemed at first willing to come to an agreement with Timur, and to dread his superior power; yet he now behaved in such an unsatisfactory manner, that the Tartar monarch desired him to prepare for war; upon which he raised the siege of Constantinople, and having met Timur with an army greatly inferior to the Tartars, was utterly defeated and taken prisoner. According to some accounts, he was treated with great humanity and honour; while others inform us, that he was shut up in an iron cage, against which he dashed out his brains the following year. At any rate, it is certain that he was not restored to liberty, but died in confinement.

20 Bajazet defeated and taken prisoner.

This victory was followed by the submission of many places of the Lesser Asia to Timur; the Greek emperor owned himself his tributary, as did also the sultan of Egypt. After this, Timur once more returned to Georgia, which he cruelly ravaged; after which he marched to Samarcand, where he arrived in the year 1405. Here, being now an old man, this mighty conqueror began to look forward to that state which at one time or other is the dread of all living creatures; and Timur, in order to quiet the remorses of his own conscience, came to the following curious resolution, which he communicated to his intimate friends; namely, that "as the vast conquests he had made were not obtained without *some violence*, which had occasioned the destruction of a great number of God's creatures, he was resolved, by way of atonement for his past crimes, to perform some good action; namely, to make war on the infidels, and exterminate the idolaters of China." This atonement, however, he did not live to accomplish; for he died the same year

21 Death of Tamerlane and dissolution of his empire.

Moguls. year of a burning fever, in the 71ft year of his age and 36th of his reign.

On the death of Timur, his empire fell immediately into great diforder, and the civil wars continued for five or fix years; but at laft peace was reftored, by the fettlement of Shah Rukh, Timur's fon, on the throne. He did not, however, enjoy the empire in its full extent, or indeed much above one half of it; having only Karazm, Khoraffan, Kandahar, Perfia, and part of Indoftan. Neither was he able, though a brave and warlike prince, to extend his dominions, though he tranfmitted them to his fon Ulug Beg. He proved a wife and learned monarch; and is famous for the aftronomical tables which he caufed to be compofed, and which are well known at this day. He was killed in 1448 by his fon Abdollatif, who fix months after was put to death by his own foldiers. After the death of Abdollatif, Abdollah, a grandfon of Shah Rukh, feized the throne; but, after reigning one year, was expelled by Abufaid Mirza, the grandfon of Miran Shah the fon of Timur. His reign was one continued fcene of wars and tumults; till at laft he was defeated and taken prifoner by one Haffan Beg, who put him to death in 1468. From this time we may look upon the empire of Timur as entirely diffolved, though his defcendants ftill reigned in Perfia and Indoftan, the latter of which is ftill known by the name of the *Mogul's empire*.

22 History of Indoftan. On the death of the above mentioned monarch, his fon Babr or Babor fucceeded him, but was foon driven out by the Ufbeck Tartars; after which he refided fome time in Gazna, whence he made incurfions into Hindoftan, and at length became mafter of the whole empire, excepting the kingdoms of Dekan, Guzerat, and Bengal.—For the tranfactions fubfequent to this period, fee the articles HINDOSTAN and INDIA. What remains to be fupplied here is an account of the revolution that has lately happened at Delhi the capital of the Mogul empire.

Gholam Kahdur, author of the revolution, was the fon of Zabda Khan. His father difinherited him, and drove him from his prefence on account of his vices and his crimes. Shah Allum, the king of Delhi, took him under his protection, treated him as his own fon, and conferred on him the firft title in the kingdom, Amere ul Omraow. He lived with the king, and raifed a body of about 8000 troops of his own countrymen the Moguls, which he commanded. Gholam Khadur was of a paffionate temper, haughty, cruel, ungrateful, and debauched. In the latter end of the year 1788, the king had formed fufpicions that fome of the neighbouring rajahs (princes) would make an attempt to plunder and deftroy his territories. Thefe fufpicions were verified by the approach of a confiderable army towards his capital, commanded by Ifmael Beg Khan, and affifted by Scindia. Gholam Khadur told the king on this, that he had nothing to fear; for that he had an army fufficiently ftrong to oppofe the enemy: that all the king had to do was to march out with his troops, give them a fupply of cafh, and he would lay his head on the enemy's being overcome. The king on this replied, that he had no money to carry on a conteft. Gholam Khadur faid, that this objection would foon be obviated, as he (Gholam Khadur) would advance the neceffary fupply of cafh, and that all his majefty had to do was to head the army. "This (faid he) will animate them and give them confidence; the prefence of a monarch is above half the battle." The king agreed in appearance, and requefted Gholam Khadur to affemble the army, pay their arrears, and inform them of his intentions. Gholam Khadur retired contented: but great was his aftonifhment, when he intercepted the next day a letter from the king to Scindia, defiring him to make as much hafte as poffible, and deftroy Gholam Khadur; for, fays he, Khadur wifhes me to act contrary to my wifhes, and oppofe you. On this difcovery, Gholam Khadur marched out with his Moguls, croffed the Jumna, and encamped on the other fide oppofite the fort of Delhi. He fent to the king the intercepted letter, and afked him if his conduct did not deferve to be punifhed by the lofs of his throne?—He began to befiege the fort, and carried it in a few days. He entered the palace in arms; flew to the king's chamber; infulted the old man in the moft barbarous manner; knocked him down; and, kneeling on his breaft, with his knife took out one of his eyes, and he ordered a fervant of the king's to take out the other.

After this he gave up the palace to pillage, and went to the king's zazana (the refidence of his women); where he infulted the ladies, and tore their jewels from their nofes and ears and off their arms and legs. As he had lived with the king, he was well acquainted with the different places where the king's treafures were hid; he dug up the floor of the king's own bed-room, and found there two chefts, containing in fpecie 120,000 gold mohurs, or L. 192,000 fterling; this he took, and vaft fums more. To get at the hidden jewels of the women, he practifed one of the moft villainous fchemes that ever was thought of. The third day after thefe horrid cruelties, he ordered that all the king's ladies and daughters fhould come and pay their refpects to him, and promifed to fet thofe free who could pleafe him by their appearance and drefs. The innocent, unthinking women, brought out their jewels, and adorned themfelves in their richeft attires to pleafe this favage. Gholam Khadur commanded them to be conveyed into a hall, where he had prepared common dreffes for them; thefe dreffes he made them put on by the affiftance of eunuchs; and taking poffeffion of their rich dreffes and jewels, fent the women home to the palace to lament their lofs and curfe his treachery. Gholam Khadur did not even ftop here; but infulted the princes, by making them dance and fing. The moft beautiful of the king's daughters, Mobaruck ul Moulk, was brought to this tyrant to gratify his luft: but fhe refifted, and is faid to have ftabbed herfelf in order to avoid force.

Scindia foon after this came to the affiftance of the king, rather to make him his prey. Gholam Khadur fled and took refuge in the fort of Agra, a large city about 150 miles from Delhi. Scindia's troops befieged him there. Perceiving at laft that he muft be taken if he continued in the fort, he took the advantage of a dark night, fluffed his faddle with a large ftock of precious ftones, took a few followers, and fled from the fort towards Perfia. Unluckily for him, he fell off his horfe the fecond night after his flight; by

2 this

this means a party of horse which had been sent in pursuit of him came up with him, and took him prisoner. He was brought to Scindia; who, after exposing him for some time in irons, and some time in a cage, ordered his ears, his nose, his hands, and his feet, to be cut off, and his eyes taken out; in which state he was allowed to expire.

Scindia has rewarded himself by seizing upon the kingdom which he came to guard: And all that now belongs to Shah Allum, the nominal emperor, is the city of Delhi, with a small district around it, where, even deprived of sight, he remains an empty shadow of royalty; an instance of the instability of human greatness, and of the precarious state of despotic governments.

MOHAIR, in commerce, the hair of a kind of goat frequent about Angria in Turkey; the inhabitants of which city are all employed in the manufacture of camblets made of this hair.

Some give the name *mohair* to the camblets or stuffs made of this hair: of these there are two kinds; the one smooth and plain, the other watered like tabbies. the difference between the two only consists in this, that the latter is calendered, the other not. There are also mohairs both plain and watered, whose woof is of wool, cotton, or thread.

Mohair-Shell, in conchyliology, a name given to a peculiar species of voluta, which seems of a closely and finely reticulated texture, and resembles on the surface a piece of mohair or a very close silk-worm's web.

MOHAWKS. See Muck.

Mohawk Country, a part of North America, inhabited by one of the five nations of the Iroquois, situated between the province of New York and the lake Ontario or Frontignac.

MOHILA, or Moelia, one of the Comorra islands in the Indian sea, between the north end of the island of Madagascar and the continent of Africa. The inland parts are mountainous and woody; but the lands adjoining to the sea are watered by several fine streams which descend from the mountains; and the grass is green all the year, so that it affords a most delightful habitation. There are plenty of provisions of all kinds; and the East India ships of different nations sometimes touch here for refreshment.

MOHILOF, a large and strong city of Poland, in the province of Lithuania, and palatinate of Msciflau. It is well built, populous, and has a considerable trade. Near this place the Swedes obtained a great victory over the Russians in 1707.

MOIDORE, a Portuguese gold coin, value 1l. 7s. Sterling.

MOIETY *(Medietas)*, the half of any thing.

MOINE (Peter le), was born at Chaumont in Bassigni, A. D. 1602, and died at Paris August 22. 1672, aged 70. He joined the society of Jesuits, and enjoyed several offices among them. He is chiefly known by his verses, which were collected into one volume folio in 1671. Father le Moine is the first of the French poets belonging to that famous society, who acquired reputation by this species of writing. It cannot be denied that this poet possessed genius and fancy; but his imagination was ungoverned, which is particularly the case in his poem of *Saint Louis*. Despreaux, when asked his opinion of this poet, replied, That "he was too extravagant for praise, and too much a poet for censure." To give his character in one word, he was a pedant who had a lively imagination without taste, and who, far from restraining his impetuous genius, abandoned himself without reserve to its direction. Hence his gigantic figures, his crowd of metaphors, his ridiculous antitheses, his hyperbolical expressions, &c. This Jesuit somewhere says, "that the water of the river on the banks of which he had composed his verses, was so admirably qualified to make poets, that though it were converted into holy water, it would not protect a man against the dæmon of poetry." The prose of father le Moine is in the same brilliant and bombast style. Senault, a father of the oratory, used to say of him, that he was Balzac in a theatrical dress." Among his prose works are, 1. *La Devotion aisée*, Paris, 1652, 8vo; an extraordinary book which produced more mirth than devotion. 2. *Pensées Morales*. On these two books the reader may consult Paschal's ninth and tenth provincial letters. 3. A short Treatise on History, in 12mo; in which we find many pleasant and curious thoughts mixed with a good deal of common-place.

Moine (Stephen le), a very learned French minister of the Protestant religion, was born at Caen in 1624. He became extremely skilled in the Greek, Latin, and Oriental tongues, and professed divinity with high reputation at Leyden, in which city he died in 1689. Several dissertations of his are printed together, and intituled *Varia Sacra*, in 2 vols 4to; besides which, he wrote other works.

Moine (Francis le), an excellent French painter, was born at Paris in 1688, and trained up under Galloche professor of the academy of painting; which office he himself afterwards filled. Le Moine painted the grand saloon which is at the entrance into the apartments of Versailles, and which represents the apotheosis of Hercules. He was four years about it; and the king, to show how well pleased he was with it, made him his first painter in 1736, and gave him a pension of 4000 livres. A fit of lunacy seized this painter the year after; during which he run himself through with his sword, and died, June 4. 1737, aged 49.

MOIRA (sometimes written *Moyra*), a town of Ireland, situated in the county of Down and province of Ulster, 69 miles from Dublin; noted for its linen manufacture, and a monthly market for vending the same. It gives title of earl to the family of Rawdon. Lord Moira has here a very beautiful seat; and here is a handsome church, a charity school, and two dissenting meeting-houses.

MOISTURE. See Humidity.

The moisture of the air has considerable effects on the human body. For the quantity and quality of the food, and the proportion of the meat to the drink, being given, the weight of a human body is less, and consequently its discharges greater in dry weather than in wet weather; which may be thus accounted for: the moisture of the air moistens the fibres of the skin and lessens perspiration by lessening their vibratory motion. When perspiration is thus lessened by the moisture of the air, urine indeed is by degrees increased,

increaſed, but not equally. Hence, according to Dr Bryan Robinſon, we learn, that to keep a body of the ſame weight in wet weather as in dry, either the quantity of food muſt be leſſened, or the proportion of the meat to the drink increaſed; and both theſe may be done by leſſening the drink without making any change in the meat.

The inſtrument uſed for determining the degree of moiſture in the air, is called an *hygrometer*. See Hygrometer.

MOIVRE (Abraham), was born at Vitri in Champagne, A. D. 1667. His father was a ſurgeon. At the revocation of the edict of Nantes, he determined to fly into England rather than abandon the religion of his fathers. Before he left France, he had begun the ſtudy of Mathematics; and having perfected himſelf in that ſcience in London, he was obliged, by the meanneſs of his circumſtances, to teach it. Newton's *Principia*, which accidentally fell into his hands, ſhowed him how little progreſs he had made in a ſcience of which he thought himſelf maſter. From this work he acquired a knowledge of the geometry of infinites with as great facility as he had learned the elementary geometry; and in a ſhort time he was fit to be ranked with the moſt celebrated mathematicians. His ſucceſs in theſe ſtudies procured him a ſeat in the Royal Society of London and in the Academy of Sciences at Paris. His merit was ſo well underſtood in the former, that he was thought capable of deciding in the famous diſpute between Leibnitz and Newton concerning the differential calculus. —He publiſhed a Treatiſe on Chances in 1738, and another on annuities in 1752; both extremely accurate. The Philoſophical Tranſactions contain many intereſting memoirs of his compoſition.— Some of them treat of the method of fluxions; others are on the lunula of Hippocrates; others on phyſical aſtronomy, in which he reſolved many important problems; and others, in ſhort, on the analyſis of the games of chance, in which he followed a different courſe from that of Montmort. Towards the cloſe of his life he loſt his ſight and hearing; and the demand for ſleep became ſo great that he required 20 hours of it in a day. He died at London, 1754, aged 87. His knowledge was not confined to mathematics; but he retained to the laſt a taſte for polite literature. He was intimately acquainted with the beſt authors of antiquity; and he was frequently conſulted about difficult paſſages in their works. Rabelais and Moliere were his favourite French authors; he had them by heart; and he one day obſerved to one of his acquaintance, "that he would rather have been Moliere than Newton." He recited whole ſcenes of the *Miſanthrope* with that delicacy and force with which he remembered to have heard them recited at Paris 70 years before, by Moliere's own company. The character indeed was ſomewhat ſimilar to his own. He judged ſeverely of mankind; and could never conceal his diſguſt at the converſation of a fool, nor his averſion to cunning and diſſimulation. He was free from the affectation of ſcience; and no one could know him to be a mathematician but from the accuracy of his thoughts. His converſation was general and inſtructive. Whatever he ſaid was well digeſted and clearly expreſſed. His ſtyle poſſeſſed more ſtrength and ſolidity than ornament and animation; but he was always correct, and he beſtowed as much pains on his ſentences as on his calculations. He could never endure any bold aſſertions or indecent witticiſms againſt religion. "I ſhow you that I am a Chriſtian (ſaid he one day to a perſon who thought to pay him a compliment by obſerving that mathematicians were attached to no religion), by forgiving the ſpeech you have now made." The practice of giving vails to ſervants was not laid aſide in his time; and, on this account, when a nobleman aſked him why he did not dine oftener with him? "You muſt excuſe me, my lord (replied he), I cannot afford it."

MOLA (Pietro Franceſco), an eminent painter, was born, according to moſt authors, at Lugano, a city belonging to the Switzers, in the year 1609. Others affirm, that the place of his birth was Coldra, in the diſtrict of Como. He was at firſt the diſciple of Giuſeppe d'Arpino, and afterwards of Albano. When he quitted the ſchool of the latter, he went to Venice, and ſtudied aſſiduouſly the pictures of Titian, Tintoretto, Baſan, and Paolo Veroneſe. He painted hiſtorical ſubjects and landſcapes with great ſucceſs; but his genius ſeemed more particularly adapted to the latter. His pictures, in both ſtyles, are ſpoken of with the warmeſt commendations. He died in 1665.—He had a brother, *Giovanni Batiſta*, who was alſo a painter, and of ſome merit, but very inferior to that of the older.

Mola, an ancient town of Italy, in the kingdom of Naples, and in the Terra di Lavoro, where they pretend to ſhow the ruins of Cicero's houſe. It is ſeated on the gulf of Venice, in E. Long. 17. 50. N. Lat. 41. 5.

Mola Salſa, (*Salt Cake*), in antiquity, was barley parched, and afterwards ground to meal or flour, then mixed with ſalt and frankincenſe, with the addition of a little water. Thus prepared, it was ſprinkled between the horns of the victim before it was killed in ſacrifice. This act was called *immolatio*, and was common to the Greeks as well as Romans; with this difference, that the *mola* of the Romans was of wheat. The Greeks called it ὐλη or ὐλοχυτη.

MOLARES, or Dentes molares, in anatomy, the large teeth, called in Engliſh the *grinders*. See Anatomy, n° 27.

MOLASSES, or Molosses. See Molosses.

MOLDAVIA, a province of Turkey in Europe, bounded on the north-eaſt by the river Nieſter, which divides it from Poland; on the eaſt, by Beſſarabia; on the ſouth by the Danube, which parts it from Bulgaria; and on the weſt, by Walachia and Tranſilvania; it being 240 miles in length and 150 in breadth. It lies in a good air and fruitful ſoil, producing corn, wine, rich paſtures, a good breed of horſes, oxen, ſheep, plenty of game, fiſh, fowl, honey, wax, and all European fruits. Its principal rivers are the Danube, Nieſter, Pruth, Bardalach, and Ceret. The inhabitants are Chriſtians of the Greek church, and Jaſſy is the principal town. It has been tributary to the Turks ever ſince the year 1574; who appoint a prince who is a native of the country, but have no regard to his being of the principal families. They pay a large yearly tribute; beſides which, they are obliged to raiſe a great body of horſe at their own expence.

Mole.

MOLE, a river in Surry, which has taken its name from running under ground. It firft difappears at Box-hill, near Darking, in the county of Surry, and emerges again near Leatherhead.

MOLE, in zoology. See Talpa.

Moles in the fields may be deftroyed by taking a head or two of garlic, onion, or leek, and putting it into their holes; on which they will run out as if frighted, and you may kill them with a fpear or dog. Or pounded hellebore, white or black, with wheat-flour, the white of an egg, milk, and fweet-wine, or metheglin, may be made into a pafte, and pellets as big as a fmall nut may be put into their holes: the moles will eat this with pleafure, and will be killed by it. In places where you would not dig nor break much, the fuming their holes with brimftone, garlic, or other unfavoury things, drives them away; and if you put a dead mole into a common haunt, it will make them abfolutely forfake it.

Or take a mole-fpear or ftaff, and where you fee them caft, go lightly; but not on the fide betwixt them and the wind, left they perceive you; and at the firft or fecond putting up of the earth, ftrike them with your mole-ftaff downright, and mark which way the earth falls moft: if fhe cafts towards the left hand, ftrike fomewhat on the right hand; and fo on the contrary, to the cafting up of the plain ground, ftrike down, and there let it remain; then take out the tongue in the ftaff, and with the fpattle, or flat edge, dig round about your grain to the end thereof, to fee if you have killed her; and if you have miffed her, leave open the hole and ftep afide a little, and perhaps fhe will come to ftop the hole again, for they love but very little air; and then ftrike her again; but if you mifs her, pour into the hole two gallons of water, and that will make her to come out for fear of drowning: mind them going out of a morning to feed, or coming home when fed, and you may take a great many.

Mole, in midwifery, a mafs of flefhy matter, of a fpherical figure, generated in the uterus, and fometimes miftaken for a child. See Midwifery.

Mole, or *Mark*. See Nævus.

Mole, in architecture, a maffive work formed of large ftones laid in the fea by means of coffer dams, extended either in a right line or an arch of a circle, before a port, which it ferves to clofe; to defend the veffels in it from the impetuofity of the waves, and to prevent the paffage of fhips without leave. Thus we fay the mole of the harbour of Meffina, &c.

Mole is fometimes alfo ufed to fignify the harbour itfelf.

Mole, (*moles*,) among the Romans, was alfo ufed for a kind of maufoleum, built in manner of a round tower on a fquare bafe, infulate, encompaffed with columns, and covered with a dome.—The mole of the emperor Adrian, now the caftle of St Angelo, was the greateft and moft ftately of all the moles. It was crowned with a brazen pine-apple, wherein was a golden urn containing the afhes of the emperor.

Mole Cricket, in zoology. See Gryllotalpa.

Mole-Hills. These little hillocks of earth are a very great prejudice to the pafture lands, not only in wafting fo much of the land as they cover, but in hindering the fcythe in mowing. In the weft of England they ufe a peculiar inftrument for the breaking up of thefe; it is a flat board, very thick, and of about eight inches in diameter, into which there is faftened a perpendicular handle of three or four feet long. It has four broad and fharp iron teeth at the front, which readily cut through the hill, and fpread the earth it confifts of; and behind there is a large knob proper for breaking the clods with, if there are any. Some ufe a fpade, or other common inftrument, in the place of this, but not fo well. There is, however, a much better inftrument even than this, for deftroying thefe hills, where they are in very great numbers. This is a kind of horfe-machine; it has a fharp iron about three feet over, and with a ftrong back.—It is about four or five inches broad, and has two long handles for a horfe to be harneffed to, and a crofs bar of iron to ftrengthen it at the bottom of the handles, reaching from the one handle to the other. The middle of this crofs-bar is furnifhed with one, two, or more fharp pieces of iron like fmall plough-fhares, to cut the mole-hills into two, three, or more parts. The iron behind is of a femicircular figure. A fingle horfe is harneffed to this machine, and a boy muft be employed to drive it, and a man to hold and guide it; the fharp irons or fhares are the firft things that meet the hill, they run through it, break its texture, and cut it into feveral parts; and the circular iron following immediately behind them, cuts up the whole by the roots, and leaves the land level. This inftrument will deftroy as many mole-hills in one day as a common labourer can in eight, and would be of very great advantage to the kingdom if brought into general ufe. It is to be obferved, that this leaving a naked fpace in the place of every hill, it will be neceffary to go over the land, and fow them with hay feed, otherwife thefe fpots will want the produce of grafs the firft years. The farmers in fome parts of England are not willing to deftroy the mole-hills, but let them ftand from year to year, fuppofing that they get fome ground by them, but the advantage by this means is fo little, that it does not balance the unfightlinefs and damage to the mowing.

Mole Molefworth

MOLESWORTH (Robert), Vifcount Molefworth, an eminent ftatefman and polite writer, born at Dublin in 1656, where his father was a merchant. He was attainted by King James for his activity on the prince of Orange's invafion; but the latter, when he was fettled on the throne, called up Mr Molefworth into the privy-council, and fent him envoy-extraordinary to the court of Denmark. Here he refided above three years, and then returned upon fome difguft, without an audience of leave. Upon his return, he drew up his Account of Denmark, a work well known, in which he reprefented that government as arbitrary; and hence gave great offence to George prince of Denmark. The Danifh envoy prefented a memorial to King William concerning it; and then furnifhed materials for an anfwer, which was executed by Dr William King. Mr Molefworth was member of the houfes of commons in both kingdoms: King George I. made him a commiffioner of trade and plantations, and advanced him to the peerage of Ireland, by the title of *Baron Philipftown*, and *Vifcount Molefworth of Swords*.

Swords. He died in 1725. Befides his Account of Denmark, he wrote an addrefs to the houfe of commons, for the encouragement of agriculture; and tranflated Franco Gallia, a Latin treatife of the civilian Hottoman, giving an account of the free ftate of France, and other parts of Europe, before the encroachments made on their liberties.

MOLIERE (John Baptift), a famous French comedian, whofe true name was *Pocquelin*, which for fome reafon or other he funk for that of Moliere He was the fon of a valet de chambre, and was born at Paris about the year 1620. He went through the ftudy of the claffics under the Jefuits in the college of Clermont, and was defigned for the bar; but at his quitting the law-fchools, he made choice of the actor's profeffion. From the prodigious fondnefs he had for the drama, his whole ftudy and application being directed to the ftage, he continued till his death to exhibit plays, which were greatly applauded. It is faid the firft motive of his going upon the ftage was to enjoy the company of an actrefs for whom he had contracted a violent fondnefs. His comedies are highly efteemed. And it is no wonder he fo juftly reprefented domeftic feuds, and the torments of jealous hufbands, or of thofe who have reafon to be fo, it being afferted that no man ever experienced all this more than Moliere, who was very unhappy in his wife. His laft comedy was *La Malade imaginaire*, which was brought on the ftage in 1673; and Moliere died on the fourth night of its reprefentation; fome fay in acting the very part of the pretended dead man, which gave fome exercife for the wits of the time; but according to others he died in his bed that night, from the burfting of a vein in his lungs by coughing. The king, as a laft mark of his favour, prevailed with the archbifhop of Paris to fuffer him to be buried in confecrated ground; though he had irritated the clergy by his *Tartuff*. The moft efteemed editions of his works are that of Amfterdam, 5 vols 12mo, 1699; and that of Paris, 6 vols 4to, 1734.

MOLINA (Lewis), a Spanifh lawyer, who was employed by Philip II. king of Spain in the councils of the Indies and of Caftile. He is the author of a learned treatife concerning the entails of the ancient eftates of the Spanifh nobility, entitled, *De Hifpanorum Primogenitorum Origine et Natura*, publifhed in 1603, in folio. This book is likewife applicable to feveral provinces in France. Lewis Molina muft not be confounded with John Molina, a Spanifh hiftorian, author of *Cronica antiqua d' Aragon*, publifhed in 1524, in folio; and alfo of *De las Cafas memorables d'Efpagna*, in folio. The firft work appeared at Valencia, and the fecond at Alcala.

MOLINÆUS. See Moulin.

MOLINISTS, in ecclefiaftical hiftory, a fect in the Romifh church, who follow the doctrine and fentiments of the Jefuit Molina, relating to fufficient and efficacious grace. He taught that the operations of divine grace were entirely confiftent with the freedom of human will; and he introduced a new kind of hypothefis to remove the difficulties attending the doctrines of predeftination and liberty, and to reconcile the jarring opinions of Auguftines, Thomifts, Semi-Pelagians, and other contentious divines. He affirmed, that the decree of predeftination to eternal glory was founded upon a previous knowledge and confideration of the merits of the elect; that the grace, from whofe operation thefe merits are derived, is not efficacious by its own intrinfic power only, but alfo by the confent of our own will, and becaufe it is adminiftered in thofe circumftances, in which the Deity, by that branch of his knowledge which is called *fcientia media*, forefees that it will be efficacious. The kind of prefcience, denominated in the fchools *fcientia media*, is that foreknowledge of future contingents that arifes from an acquaintance with the nature and faculties of rational beings, of the circumftances in which they fhall be placed, of the objects that fhall be prefented to them, and of the influence which their circumftances and objects muft have on their actions.

MOLINOS (Michael), a Spanifh prieft, who endeavoured to fpread new doctrines in Italy. He was born in the diocefe of Saragoffa in 1627; and entered into prieft's orders, though he never held any ecclefiaftical benefice. He was a man of good fenfe and learning, and his life was examplary; though, inftead of practifing aufterities, he gave himfelf up to contemplation and myftical devotion. He wrote a book intitled, *Il Guida Spirituale*, containing his peculiar notions, which was greedily read both in Italy and Spain. His followers are called *Quietifts*; becaufe his chief principle was, that men ought to annihilate themfelves in order to be united to God, and afterwards remain in quietnefs of mind, without being troubled for what fhall happen to the body. He was taken up in 1687; and his 68 propofitions were examined by the pope and inquifitors, who decreed that his doctrine was falfe and pernicious, and that his books fhould be burned. He was forced to recant his errors publicly in the Dominicans church, and was condemned to perpetual imprifonment. He was 60 years old when he was taken, and had been fpreading his doctrine 22 years before. He died in prifon in 1692.

MOLINOSISTS, a fect among the Romanifts, who adhere to the doctrine of Molinos. Thefe are the fame with what are otherwife called *Quietifts*.

MOLLOY (Charles, Efq;), defcended from a good family in the kingdom of Ireland, was born in the city of Dublin, and received part of his education at Trinity college there, of which he afterwards became a fellow. At his firft coming to England he entered himfelf of the Middle Temple, and was fuppofed to have had a very confiderable hand in the writing of a periodical paper called "Fog's Journal;" as alfo fince that time to have been almoft the fole author of another well-known paper, intitled "Common Senfe." All thefe papers give teftimony of ftrong abilities, great depth of underftanding, and clearnefs of reafoning. Dr King was a confiderable writer in the latter, as were lords Chefterfield and Lyttleton. Our author had large offers made him to write in defence of Sir Richard Walpole, but thefe he rejected: notwithftanding which, at the great change in the miniftry in 1742, he was entirely neglected, as well as his fellow labourer Amherft, who conducted "The Craftfman." Mr Molloy, however, having married a lady of fortune, was in circumftances which enabled him to treat the ingratitude of his patriotic friends with the contempt it deferved. He lived many years after this period, dying fo lately as July 16. 1767.

He alſo wrote three dramatic pieces, viz. The perplexed Couple; The Coquet; and, The Half-pay Officers; none of which met with much ſucceſs.

MOLLUGO, African chickweed: A genus of the trigynia order, belonging to the triandria claſs of plants; and in the natural method ranking under the 22d order, *Caryophyllei*. The calyx is pentaphyllous; there is no corolla; the capſule is trilocular, and trivalved. Its characters are theſe: The empalement of the flower is compoſed of five oblong ſmall leaves, coloured on their inſides, and permanent; the flower has five oval petals ſhorter than the empalement; and three briſtly ſtamina, which ſtand near the ſtyle, terminated by ſingle ſummits; it has an oval germen, having three furrows, ſupporting three very ſhort ſtyles: the germen becomes an oval capſule with three cells, filled with ſmall kidney-ſhaped ſeeds. There are ſeveral ſpecies, few of which are admitted into gardens. Miller reckons two and Linnæus five ſpecies. This plant is ſaid to have an aperitive virtue.

MOLUSCA, in the Linnæan ſyſtem, is the denomination of the ſecond genus of vermes or worms. Theſe are ſimple naked animals, not included in a ſhell, but furniſhed with limbs, and comprehend eighteen ſubordinate genera, and one hundred and ten ſpecies.

MOLO, a philoſopher of Rhodes, called alſo Apollonius. Some are of opinion that Apollonius and Molo are two different perſons, who were both natives of Alabanda, and diſciples of Menecles of the ſame place. They both viſited Rhodes, and there opened a ſchool; but Molo came ſome time after Apollonius. Molo had Cicero and J. Cæſar among his pupils.

MOLOCH, a falſe god of the Ammonites, who dedicated their children to him, by making them "paſs through the fire," as the ſcriptures expreſs it. There are various opinions concerning this method of conſecration. Some think, the children leaped over a fire ſacred to Moloch; others, that they paſſed between two fires; and others, that they were really burnt in the fire, by way of ſacrifice to this god. There is foundation for each of theſe opinions. For, firſt, it was uſual among the pagans to luſtrate or purify with fire; and, in the next place, it is expreſsly ſaid, that the inhabitants of Sepharvaim burnt their children in the fire to Anamelech and Adramelech; much ſuch deities as Moloch of the Ammonites.

Moſes, in ſeveral places, forbids the Iſraelites to dedicate their children to this god as the Ammonites did, and threatens death and utter extirpation to ſuch perſons as were guilty of this abominable idolatry. And there is great probability that the Hebrews were much addicted to the worſhip of this deity; ſince Amos, and after him St Stephen, reproaches them with having carried along with them into the wilderneſs the tabernacle of their god Moloch.

Solomon built a temple to Moloch upon the mount of Olives; and Manaſſeh, a long time after, imitated his impiety, by making his ſon paſs through the fire in honour of Moloch. It was chiefly in the valley of Tophet and Hinnom, to the eaſt of Jeruſalem, that the Iſraelites paid their idolatrous worſhip to this falſe god of the Ammonites.

There are various ſentiments concerning the relation which Moloch had to the other pagan divinities. Some believe he was the ſame with Saturn, to whom it is well known that human ſacrifices were offered. Others ſuppoſe him to be Mercury; others, Mars; others, Mithras; and others, Venus. Laſtly, others take Moloch to be the ſun, or the king of heaven. Moloch was likewiſe called *Milkom*; as appears from what is ſaid of Solomon, that he went after Aſhtaroth the abomination of the Zidonians, and Milkom the abomination of the Ammonites.

MOLOSSES, Molasses, or *Melaſſes*, that groſs fluid matter remaining of ſugar after refining, and which no boiling will bring to a conſiſtence more ſolid than that of ſyrup; hence alſo called *ſyrup of ſugar*.

Properly, moloſſes are only the ſediment of one kind of ſugar called *chypre*, or brown ſugar, which is the refuſe of other ſugars not to be whitened or reduced into loaves.

Moloſſes are much uſed in Holland for the preparation of tobacco, and alſo among poor people inſtead of ſugar. There is a kind of brandy or ſpirit made of moloſſes; but by ſome held exceedingly unwholeſome. See below.

Artificial Molosses. There has been found a method of making moloſſes from apples without the addition of ſugar. The apple that ſucceeds beſt in this operation is a ſummer ſweeting of a middle ſize, pleaſant to the taſte, and ſo full of juice that ſeven buſhels will yield a barrel of cyder.

The manner of making it is this: the apples are to be ground and preſſed, then the juice is to be boiled in a large copper, till three quarters of it be evaporated: this will be done with a moderate fire in about ſix hours, with the quantity of juice above mentioned; by this time it will be of the conſiſtence and taſte as well as of the colour of moloſſes.

This new moloſſes ſerves to all the purpoſes of the common kind, and is of great uſe in preſerving cyder. Two quarts of it, put into a barrel of racked cyder, will preſerve it, and give it an agreeable colour.

The invention of this kind of moloſſes was owing to Mr Chandler of Woodſtock in New England, who living at a diſtance from the ſea, and where the common molaſſes was very dear and ſcarce, provided this for the ſupply of his own family, and ſoon made the practice among people of the neighbourhood. It is to be obſerved, that this ſort of apple, the ſweeting, is of great uſe in making cyder, one of the very beſt kinds we know being made of it. The people in New England alſo feed their hogs with the fallings of their orchards of theſe apples; and the conſequence of this is, that their pork is the fineſt in the world.

Molosses Spirit; a very clean and pure ſpirit, much uſed in England, and made from moloſſes or common treacle diſſolved in water, and fermented in the ſame manner as malt or the common malt ſpirit. See Distillation, nº 10.

Moloſſes ſpirit coming dearer than that of malt, it is frequently met with baſely adulterated with a mixture of that ſpirit, and indeed ſeldom is to be bought without ſome daſh of it. Many have a way of mixing malt in the fermenting liquor; by this the yield of the whole is greatly increaſed, and the maker may aſſure the buyer that the ſpirit is pure as it ran from the worm.

In moſt of the nice caſes in our compound diſtillery,

lery, the molosses spirit supplies the place of a pure and clean spirit. Our cinnamon, citron, and other fine cordial waters, are made with it; for the malt spirit would impart to these a very disagreeable flavour.

Molosses spirit gives a yellow stain to the hands or other substances dipped into it; and may therefore be of use in dyeing. It is possible also that the vinegar-makers may find use for it in their way; but the most advantageous of all its uses is to the distiller himself; a quantity of it added to new treacle intended for fermentation will be of great use in the process, and increase very considerably the quantity of spirit; but the proportion in regard to the new matter must not be too great.

MOLOSSI, a people of Epirus, who inhabited that part of the country which was called *Molossia* or *Molossus*, from king Molossus, a son of Pyrrhus and Andromache. This country had the bay of Ambracia on the south, and the country of the Perrhæbeans on the east. The dogs of the place were famous, and received the name of *Molossi* among the Romans. Dodona was the capital of the country, according to some writers. Others, however, reckon it as the chief city of Thesprotia.

MOLOSSUS, in the Greek and Latin poetry, a foot consisting of three long syllables. As *audiri*, *cantabant*, *virtutem*.

It takes its name either from a dance in use among the people called *Molossi* or *Epirotæ*; or from the temple of Jupiter Molossus, where odes were sung, in which this foot had a great share; or else because the march of the Molossi, when they went to the combat, was composed of these feet, or had the cadence thereof. The same foot was also called among the ancients, *Vertumnus*, *extensipes*, *hippius*, & *canius*.

MOLSA (Francis Maria), an eminent poet of the 16th century, was born at Modena. He gained so prodigious a reputation by his Latin and Italian poetry, that, as Paul Jovius tells us, "for 30 years together the patrons of wit at Rome strove to promote him." If he had behaved with the least prudence, he might easily have raised himself to considerable preferments and fortunes in the world; but he managed so ill that it was not possible to serve him.—He was entirely debauched, and at the same time devoid of all prudence and decency in the management of his pleasures. Hence he destroyed his reputation, and put an absolute stop to the progress of his fortunes. He died, in 1544, of the French disease. Molsa was a great orator as well as a great poet. He met once with a favourable opportunity of displaying his talent this way; for having seen the people of Rome highly incensed against Lorenzo de Medicis, who had struck off the heads of a great number of ancient statues, he accused him of that action, and (according to Paul Jovius) made so lively an oration upon it, that he perfectly overwhelmed him with confusion and despair: and it was generally believed that Lorenzo de Medicis was so confounded at the infamy with which he was branded in that oration, that, in order to efface it, he resolved to restore the city of Florence to its liberty, by assassinating Alexander de Medicis his near relation, which he did in 1537.

Molsa (Tarquinia), daughter of Camillo Molsa, knight of the order of St James of Spain, and granddaughter of Francis Maria Molsa, was one of the most accomplished ladies that ever appeared in the world; wit, learning, beauty, and virtue, all uniting in her in a most extraordinary degree. Her father observing, while she was yet very young, the goodness and excellence of her genius, procured her the best masters in every branch of literature and science. Lazaro Labadini, a celebrated grammarian of those times, taught her polite literature; and her Latin compositions in prose and verse show that she attained the art of writing well, and composing correctly. She became learned in Aristotle under Camillo Corcapani; Anthony Guarini the mathematician taught her the doctrine of the sphere; she learned poetry under Francis Patricius the famous philosopher; and logic and philosophy under P. Latoni, who also instructed her thoroughly in the Greek tongue. The rabbi Abraham taught her the principles of the Hebrew language; and John Marier Barbier formed her in the politeness of the Tuscan tongue; in which she has not only written a great number of easy and elegant verses, but likewise several letters and other pieces which are in high esteem with the polite and learned in Italy. Besides her original works, she has translated several things from Greek and Latin in a manner which shows her to have understood those languages as well as her own. Afterwards she learned music, as a relaxation and diversion from her more serious studies; and in this art she attained the highest degree of perfection. She used to play upon the violin as well as upon the lute, and sing to it at the same time in so exquisite a taste as charmed every hearer; and she instituted at length a choir of ladies, over which she herself used to preside. This lady was in high reputation at the court of Alphonsus II. duke of Ferrara, a prince of great judgment, and a passionate lover of every thing that was elegant; and we are told, that he stood ravished with admiration upon finding so many more accomplishments than he had been taught to expect in her. But the most authentic testimony and declaration of her high merit and character, was that which she received from the city of Rome; which, by a decree of the senate, in which all her excellences and qualifications are set forth, honoured her with the title of *Singular*, and bestowed the rights of a Roman citizen upon her and the whole family of Molsa. Molsa was married; but losing her husband without having any children, would never consent to be married again, although she was very young. She gave such lively tokens of her grief, that Patricius compares her to another Artemisia.

MOLUCILLA, in botany: A genus of the gymnospermia order, belonging to the didynamia class of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The calyx is campanulated, gradually widening larger than the corolla, and spinous.

MOLTEN-GREASE, in farriery. See there § xxii.

MOLUCCA ISLANDS, lie in the East Indian sea under the line; of which there are five principal, namely, Ternate, Tydor, Machian, Motyr, and Bachian. The largest of them is hardly 30 miles in circumference. They produce neither corn, rice, nor cattle, except

except goats: but they have oranges, lemons, and other fruits; and are most remarkable for spices, especially cloves. They have large snakes, which are not venomous, and very dangerous land crocodiles. At present they have three kings; and the Dutch, who are very strong there, keep out all other European nations, being jealous of their spice-trade. The religion is idolatry; but there are many Mahometans. They were discovered by the Portuguese in 1511, who settled upon the coast; but the Dutch drove them away, and are now masters of all these islands.

MOLWITZ, a town of Silesia, in the province of Grotska, remarkable for a battle gained by the Prussians over the Austrians in 1741. E. Long. 16. 45. N. Lat. 50. 26.

MOLY. The name of this plant is rendered famous by Homer; and hence has been much inquired into, as to its true sense, by the botanists of almost all times. The old interpreters of Homer explain this word by the "wild rue;" and the only reason for this is, that at some time, probably long after the days of Homer, the people of Cappadocia called the wild rue *moly*. But this plant is wholly different from the moly of Homer, which Theophrastus affirms grew in his time in Arcadia in great plenty, and had a round bulbous root like an onion, and long and grassy leaves like the squill. On the whole, the moly of Homer seems to have been a species of allium or garlic.

MOLYBDENA, in chemistry, a mineral often confounded with plumbago or black lead, but possessed of different properties. It is composed of scaly laminæ of various magnitudes, scarcely adhering to each other; somewhat greasy to the touch, soiling the fingers, and leaving traces on paper of a blackish grey colour. In powder it is of a bluish colour.

"Perfect molybdena (says Mr Fourcroy) slightly detonates with nitre; the residue contains molybdena, tartar, and calx of iron. From the experiments of Mr Scheele, molybdena appears to consist of a peculiar combustible matter and iron. The nature of the combustible matter is not yet perfectly known. Mr Hielm, a disciple of the celebrated Bergman, appears to have succeeded in converting it into a regulus. Mr Pelletier affirms, that he has had the same success; but the properties of this new metal have not yet been examined. The molybdenic acid appears to be a metallic one. Its weight, its styptic and austere taste, its dry and pulverulent form, its fusibility, insolubility, the colour it assumes by action of flame and combustible matters, its precipitation by nut-galls and the acid of Prussian blue, show that it is somewhat similar to the arsenical acid. This substance is so rare in France, that no chemist except M. Pelletier has had an opportunity of making a regular series of experiments upon it. It is greatly to be wished that they should be continued, especially with a view of deciding whether the molybdenic acid be truly different from all others; for I cannot avoid thinking, notwithstanding its peculiar characters, that a substance which does not become acid but by the assistance of 30 parts of weak nitrous acid, and is with so much difficulty brought to assume the saline state, ought not to be considered as an acid truly peculiar." See CHEMISTRY-*Index*; and MINERALOGY, p. 134.

Molybdena is found sometimes alongst with tin-ores and iron-ores, that are attracted by the magnet, among copperish pyrites; and also with wolfram, in Saxony, Iceland, Sweden, France, Spain, &c.

MOLYBDIA, in natural history, the name of a genus of crystals of a cubic form, or composed of six sides, at right angles, like a dye.

MOLYN (Peter), called *Tempesta* and *Pietro Mulier*, an eminent painter, was born at Haerlem in 1637. According to some authors, he was the disciple of Snyders, whose manner of painting he at first imitated. But his genius led him to the study of dismal subjects; and he so far excelled in painting tempests, storms at sea, and shipwrecks, that he was called by way of distinction *Tempesta*. His pictures are very rare, and held in the greatest estimation. The name of *Pietro Mulier*, or *de Mulieribus*, was given him on account of having caused his wife to be assassinated, in order to marry a young lady of Genoa with whom he was in love. But this villanous transaction being discovered, he was seized, imprisoned, and capitally condemned. However, the greatness of his merit as an artist occasioned a mitigation of the sentence; but he was still detained in prison, where he diligently followed his profession, and would have continued there in all probability for life, had he not met with an opportunity of escaping to Placentia, at the time Louis XIV. bombarded the city of Genoa, after he had been in confinement 16 years. To this artist are attributed several very neat prints, executed with the graver only, in a style greatly resembling that of John Vander Velde. They consist chiefly of candle-light pieces and dark subjects. M. Heinekin mentions *Peter Molyn* the elder, who was a native of Holland, and a painter; but not so eminent as Tempesta. Some suppose the prints above mentioned ought to be ascribed to the latter; as, though very neatly executed, they are laboured heavy performances, and not equal in any degree to what one might expect from the hand of an artist of so much repute as Tempesta.

MOLYNEUX (William), an excellent mathematician and astronomer, was born at Dublin in 1656, and admitted into the university of that city; which when he left, he carried with him a testimonial drawn up in an uncommon form, and in the strongest terms, signifying the high opinion conceived of his genius, the probity of his manners, and the remarkable progress he had made in letters. In 1675, he entered in the middle-temple, where he spent three years in the study of the laws of his country; but the bent of his genius lay strongly toward mathematics and philosophical studies; and even at the university he conceived a dislike to scholastic learning, and fell into the methods of Lord Bacon. Returning to Ireland in June 1678, he shortly after married Lucy the daughter of Sir William Domvile the king's attorney-general. Being master of an easy fortune, he continued to indulge himself in prosecuting such branches of natural and experimental philosophy as were most agreeable to his fancy; wherein astronomy having the greatest share, he began, about 1681, a literary correspondence with Flamstead the king's astronomer, which he kept up for several years. In 1683, he formed a design of erecting a philosophical society at Dublin, in imitation

tion of the Royal Society at London; and, by the conntenance and encouragement of Sir William Petty, who accepted the office of prefident, they began a weekly meeting that year, when our author was appointed their firft fecretary.

Mr Molyneux's reputation for learning recommended him, in 1684, to the notice and favour of the firft and great duke of Ormond, then lord-lieutenant of Ireland; and chiefly by his grace's influence he was appointed, that year, with Sir William Robinfon, furveyor general of his majefty's buildings and works, and chief engineer. In 1686, he was fent abroad by the government to view the moft confiderable fortreffes in Flanders. He travelled, in company with Lord Mountjoy, through that country, Holland, part of Germany, and France. Upon his return from Paris to London, in April 1680, he publifhed his *Sciothericum Telefcopium*, containing a defcription of the ftructure and ufe of a telefcopial dial invented by him. The feverities of Tyrconnel's government forced him, with many others, into England, where he fpent two years with his family, his place of refidence being at Chefter. In this retirement he wrote his Dioptrics, dedicated to the Royal Society. Here he loft his lady, who died foon after fhe had brought him a fon. Illnefs had deprived her of her eye-fight 12 years before, that is, foon after fhe was married; from which time fhe had been very fickly, and afflicted with extreme pains of the head. As foon as the public tranquillity was fettled in his native country, he returned home; and, upon the convening of a new parliament in 1692, was chofen one of the reprefentatives for the city of Dublin. In the next parliament, in 1695, he was chofen to reprefent the univerfity there, and continued to do fo to the end of his life; that learned body having, before the end of the firft feffion of the former, conferred on him the degree of doctor of laws. He was likewife nominated by the lord-lieutenant one of the commiffioners for the forfeited eftates, to which employment was annexed a falary of 500l. a-year; but looking upon it as an invidious office, he declined it. In 1698, he publifhed "The Cafe of Ireland ftated, in relation to its being bound by Acts of Parliament made in England:" in which he is fuppofed to have delivered all, or moft, that can be faid upon this fubject, with great clearnefs and ftrength of reafoning. Among many perfons with whom he maintained correfpondence and friendfhip, Mr Locke was in a particular manner dear to him, as appears from their letters. In the above year, which was the laft of his life, he made a journey to England, on purpofe to pay a vifit to that great man; and not long after his return to Ireland was feized with a fit of the ftone, of which died. Befides the works already mentioned, he publifhed feveral pieces in the Philofophical Tranfactions.

Molyneux (Samuel), fon of the former, was born at Chefter in July 1689; and educated with great care by his father, according to the plan laid down by Locke upon that fubject. When his father died, he fell under the management of his uncle, Dr Thomas Molyneux, an excellent fcholar and phyfician at Dublin, and alfo an intimate friend of Mr Locke; who executed his truft fo well, that Mr Molyneux became afterwards a moft polite and accomplifhed gentleman, and was made fecretary to his late majefty when he was prince of Wales. Aftronomy being his favourite ftudy, as it had been his father's, he projected many fchemes for the advancement of it, and was particularly employed in the years 1723, 1724, and 1725, in perfecting the method of making telefcopes; one of which, of his own making, he had prefented to John V. king of Portugal. In the midft of thefe thoughts, being appointed a commiffioner of the admiralty, he became fo engaged in public affairs, that he had not leifure to purfue thefe enquiries any farther; and gave his papers to Dr Robert Smith, profeffor of aftronomy at Cambridge, whom he invited to make ufe of his houfe and apparatus of inftruments, in order to finifh what he had left imperfect. Mr Molyneux dying foon after, Dr Smith loft the opportunity; yet, fupplying what was wanting from Mr Huygens and others, he publifhed the whole in his "Complete Treatife of Optics."

MOMBAZA, or Monbaza, a town of Africa, in an ifland of the fame name, with a caftle and a fort: feated on the eaftern coaft, oppofite to the country of Mombaza in Zanguebar, 70 miles fouth of Melinda, and fubject to Portugal. E. Long. 48. 0. N. Lat. 44. 0.

Mombaza, a country of Africa in Zanguebar, fubject to the Portuguefe, from whence they export flaves, gold, ivory, rice, flefh, and other provifions, with which they fupply the fettlements in Brafil. The king of this country being a Chriftian, had a quarrel with the Portuguefe governor, took the caftle by affault, turned Mahometan, and murdered all the Chriftians, in 1631; but in 1729 they became mafters of the territory again.

MOMENT, in the doctrine of time, an inftant, or the moft minute and indivifible part of duration.

MOMENTUM, in mechanics, fignifies the fame with impetus, or the quantity of motion in a moving body; which is always equal to the quantity of matter multiplied into the velocity; or, which is the fame thing, it may be confidered as a rectangle under the quantity of matter and velocity. See Mechanics.

MOMORDICA, male balsam apple: A genus of the fyngenefia order, belonging to the monoecia clafs of plants; and in the natural method ranking under the 34th order, *Cucurbitaceæ*. The male calyx is quinquefid; the corolla fexpartite; the filaments are three in number. The female calyx is trifid; the corolla quinquepartite; the ftyle trifid; the fruit is an apple parting afunder with a fpring. The moft remarkable fpecies are, 1. The balfamina, or male balfam apple. This is a native of Afia; and has a trailing ftalk like thofe of the cucumber or melon, with fmooth leaves, cut into feveral fegments, and fpread open like a hand. The fruit is oval, ending in acute points, having feveral deep angles, with fharp tubercles placed on their edges. It changes to a red or purplifh colour when ripe, opening with an elafticity, and throwing out its feeds. 2. The elaterium, wild or fpurting cucumber, has a large flefhy root, fomewhat like briony, from whence come forth every fpring feveral thick, rough, trailing ftalks, dividing into many branches, and extending every way two or three feet; thefe are garnifhed with thick, rough, almoft heart-fhaped leaves, of a grey colour,

colour, ſtanding upon long foot-ſtalks. The flowers come out from the wings of the ſtalks: theſe are male and female, growing at different places on the ſame plant like thoſe of the common cucumber: but they are much leſs, of a pale yellow colour, with a greeniſh bottom; the male flowers ſtand upon thick, ſhort, foot-ſtalks, but the female flowers ſit upon the young fruit; which, after the flower is faded, grows of an oval form, an inch and a half long, ſwelling like a cucumber, of a grey colour like the leaves, and covered over with ſhort prickles. This ſpecies has one of its names from the property of caſting out its ſeeds, together with the viſcid juice in which the ſeeds are lodged, with a violent force, if touched while ripe.

Uſes. The firſt ſpecies is famous in Syria for curing wounds. The natives cut open the unripe fruit, and infuſe it in ſweet oil, which they expoſe to the ſun for ſome days, until it becomes red; and then preſent it for uſe. Dropped on cotton, and applied to a freſh wound, the Syrians reckon this oil the beſt vulnerary next to balſam of Mecca, having found by experience that it often cures large wounds in three days. The leaves and ſtems of this plant are uſed for arbours or bowers. The elaterium of the ſhops is the fruit, or rather the inſpiſſated fæcula, of the juice of the unripe fruit of the wild cucumber. It is uſually ſent us from Spain and the ſouthern parts of France, where the plant is common. We receive it in ſmall, flat, whitiſh lumps, or cakes, that are dry, and break eaſily between the fingers. It is of an acrid, nauſeous, bitter taſte, and has a ſtrong offenſive ſmell when newly made; but theſe, as well as its other properties, it loſes after being kept for ſome time. It is a very violent purge and vomit, and is now but ſeldom uſed. From the property which the plant has of throwing out its ſeeds, it has ſometimes been called *Noli me tangere*.

MOMUS, in fabulous hiſtory, the god of raillery, or the jeſter of the celeſtial aſſembly, and who ridiculed both gods and men. Being choſen by Vulcan, Neptune, and Minerva, to give his judgment concerning their works, he blamed them all: Neptune for not making his bull with horns before his eyes, in order that he might give a ſurer blow; Minerva for building an houſe that could not be removed in caſe of bad neighbours; and Vulcan, for making a man without a window in his breaſt, that his treacheries might be ſeen. For his free reflections upon the gods, Momus was driven from heaven. He is generally repreſented raiſing a maſk from his face, and holding a ſmall figure in his hand.

MONA, two iſlands of this name in the ſea lying between Britain and Ireland. The one deſcribed by Cæſar, as ſituated in the mid-paſſage between both iſlands, and ſtretching out in length from ſouth to north. Called *Monaæda* (Ptolemy); *Monapia*, or *Monabia* (Pliny). Suppoſed to be the Iſle of Man.—Another Mona, (Tacitus); an iſland more to the ſouth, and of greater breadth; ſituated on the coaſt of the Ordovices, from which it is ſeparated by a narrow ſtrait. The ancient ſeat of the Druids. Now called *Angleſey*, the iſland of the Angles or Engliſh.

Mona, an iſland of the Baltic Sea, ſouth-weſt of the iſland of Zealand, ſubject to Denmark. E. Long. 12. 36. N. Lat. 55. 20.

Mona. See Inchcolm.

MONACO, a ſmall but handſome and ſtrong town of Italy, in the territory of Genoa, with a caſtle, citadel, and a good harbour. It is ſeated on a craggy rock, and has its own prince, under the protection of France. E. Long. 7. 33. N. Lat. 43. 48.

MONAD, ſee *Leibnitzian Philoſophy*.

MONADELPHIA, (from μονος *alone*, and αδελφια *a brotherhood*;) a "ſingle brotherhood:" The name of the 16th claſs in Linnæus's ſexual ſyſtem, conſiſting of plants with hermaphrodite flowers; in which all the ſtamina, or male organs of generation, are united below into one body or cylinder, through which paſſes the pointal or female organ. See Botany, p. 437.

MONAGHAN, a county of Ireland, ſituated in the province of Ulſter, is bounded by Tyrone on the north, Armagh on the eaſt, Cavan and Louth on the ſouth, and Fermanagh on the weſt. It is a boggy and mountainous tract, but in ſome places is well improved. It contains 170,090 Iriſh plantation acres, 24 pariſhes, five baronies, and one borough, and ſends four members to parliament. It is about 30 miles long and 22 broad. The linen trade of this county is averaged at L. 104,000 yearly.

Monaghan, a poſt, fair, and market town, and chief of the county of that name, is diſtant 62 miles from Dublin; it is a borough, and returns two members to parliament; patron Lord Clermont. It gives title of baron to the family of Blayney, and has ſix fairs. It was anciently called *Muinechan*. An abbey was founded here in a very early age, of which Moelodius the ſon of Aodh was abbot. In 1462, a monaſtery for conventual Franciſcans was erected on the ſite of this abbey, which was granted on the general ſuppreſſion of monaſteries to Edward Withe, and a caſtle has been ſince erected on the ſite by Edward Lord Blayney.

MONAMY (P.), a good painter of ſea-pieces, was born in Jerſey; and certainly (ſays Mr Walpole), from his circumſtances or the views of his family he had little reaſon to expect the fame he afterwards acquired, having received his firſt rudiments of drawing from a ſign and houſe painter on London-bridge. But when nature gives real talents they break forth in the homelieſt ſchool. The ſhallow waves that rolled under his window taught young Monamy what his maſter could not teach him, and fitted him to imitate the turbulence of the ocean. In painter's hall is a large piece by him, painted in 1726. He died at his houſe in Weſtminſter the beginning of 1749.

MONANDRIA, (from μονος *alone*, and ανηρ *a man* or *huſband*:) The name of the firſt claſs in Linnæus's ſexual ſyſtem; conſiſting of plants with hermaphrodite flowers, which have only one ſtamen or male organ.

MONARCHY, a large ſtate governed by one; or a ſtate where the ſupreme power is lodged in the hands of a ſingle perſon. The word comes from the Greek μοναρχης, "one who governs alone;" formed of μονος, *ſolus*, and αρχη *imperium*, "government." Of the three forms of government, viz. democracy, ariſtocracy, and monarchy, the laſt is the moſt powerful, all the ſinews of government being knit together, and united in the hand of the prince; but then there is

imminent danger of his employing that ſtrength to improvident or oppreſſive purpoſes. As a democracy is the beſt calculated to direct the end of a law, and an ariſtocracy to invent the means by which that end ſhall be obtained, a monarchy is moſt fit for carrying thoſe means into execution.

The moſt ancient monarchy was that of the Aſſyrians, which was founded ſoon after the deluge. We uſually reckon four grand or univerſal monarchies; the Aſſyrian, Perſian, Grecian, and Roman; though St Auguſtine makes them but two, viz. thoſe of Babylon and Rome. Belus is placed at the head of the ſeries of Aſſyrian kings who reigned at Babylon, and is by profane authors eſteemed the founder of it, and by ſome the ſame whom the ſcriptures call Nimrod. The principal Aſſyrian kings after Belus were Ninus, who built Nineveh, and removed the ſeat of empire to it; Semiramis, who, diſguiſing her ſex, took poſſeſſion of the kingdom inſtead of her ſon, and was killed and ſucceeded by her ſon Ninyas; and Sardanapalus, the laſt of the Aſſyrian monarchs, and more effeminate than a woman. After his death the Aſſyrian empire was ſplit into three ſeparate kingdoms, viz. the Median, Aſſyrian, and Babylonian. The firſt king of the Median kingdom was Arbaces; and this kingdom laſted till the time of Aſtyages, who was ſubdued and diveſted of his kingdom by Cyrus.

In the time of Cyrus there aroſe a new and ſecond monarchy called the Perſian, which ſtood upwards of 200 years from Cyrus, whoſe reign began A. M. 3468, to Darius Codomannus, who was conquered by Alexander, and the empire tranſlated to the Greeks A. M. 3674.—The firſt monarch was Cyrus, founder of the empire. 2. Cambyſes, the ſon of Cyrus. 3. Smerdis. 4. Darius, the ſon of Hyſtaſpis, who reigned 521 years before Chriſt. 5. Xerxes, who reigned 485 years before Chriſt. 6. Artaxerxes Longimanus, who reigned 464 years before Chriſt. 7. Xerxes the ſecond. 8. Ochus, or Darius, called Nothus, 424 years before Chriſt. 9. Artaxerxes Mnemon, 405 years before Chriſt. 10. Artaxerxes Ochus, 359 years before Chriſt. 11. Arſes, 338 years before Chriſt. 12. Darius Codomannus, 336 years before Chriſt, who was defeated by Alexander the Great, and deprived of his kingdom and life about 331 years before Chriſt: the dominion of Perſia after his death was tranſlated to the Greeks.

The third monarchy was the Grecian. As Alexander, when he died, did not declare who ſhould ſucceed him, there ſtarted up as many kings as there were commanders. At firſt they governed the provinces that were divided among them under the title of viceroys; but when the family of Alexander the Great was extinct, they took upon them the name of kings. Hence, in proceſs of time, the whole empire of Alexander produced four diſtinct kingdoms, viz. 1. The Macedonian; the kings of which, after Alexander, were Antipater, Caſſander, Demetrius Poliorcetes, Seleucus Nicanor, Meleager, Antigonus Doſon, Philip, and Perſeus, under whom the Macedonian kingdom was reduced to the form of a Roman province. 2. The Aſiatic kingdom, which upon the death of Alexander fell to Antigonus, comprehending that country now called Natolia, together with ſome other regions beyond Mount Taurus. From this kingdom proceeded two leſſer ones, viz. that of Pergamus, whoſe laſt king, Attalus, appointed the Roman people to be his heir; and Pontus, reduced by the Romans into the form of a province, when they had ſubdued the laſt king, Mithridates. 3. The Syrian, of whoſe twenty-two kings the moſt celebrated were, Seleucus Nicanor, founder of the kingdom; Antiochus Deus; Antiochus the Great; Antiochus Epiphanes; and Tigranes, who was conquered by the Romans under Pompey; and Syria reduced into the form of a Roman province. 4. The Egyptian, which was formed by the Greeks in Egypt, and flouriſhed near 240 years under 12 kings, the principal of whom were, Ptolemy Lagus, its founder; Ptolemy Philadelphus, founder of the Alexandrian library; and queen Cleopatra, who was overcome by Auguſtus, in conſequence of which Egypt was added to the dominion of the Romans.

The fourth monarchy was the Roman, which laſted 244 years, from the building of the city until the time when the royal power was abrogated. The kings of Rome were, Romulus, its founder; Numa Pompilius; Tullus Hoſtilius; Ancus Martius; Tarquinius Priſcus; Servius Tullius; and Tarquin the Proud, who was baniſhed, and with whom terminated the regal power.

There ſeems in reality no neceſſity to make the Medes, Perſians, and Greeks, ſucceed to the whole power of the Aſſyrians, to multiply the number of the monarchies. It was the ſame empire ſtill; and the ſeveral changes that happened in it did not conſtitute different monarchies. Thus the Roman empire was ſucceſſively governed by princes of different nations, yet without any new monarchy being formed thereby. Rome, therefore, may be ſaid to have immediately ſucceeded Babylon in the empire of the world. See Empire.

Of monarchies ſome are abſolute and deſpotic, where the will of the monarch is uncontroulable; others are limited, where the prince's authority is reſtrained by laws, and part of the ſupreme power lodged in other hands, as in Britain. See Government.

Some monarchies again are hereditary, where the ſucceſſion devolves immediately from father to ſon; and others are elective, where, on the death of the monarch, his ſucceſſor is appointed by election, as in Poland.

Fifth-Monarchy Men, in the eccleſiaſtical hiſtory of England, were a ſet of wrong-headed and turbulent enthuſiaſts who aroſe in the time of Cromwell, and who expected Chriſt's ſudden appearance upon earth to eſtabliſh a new kingdom; and, acting in conſequence of this illuſion, aimed at the ſubverſion of all human government.

MONARDA, Indian horehound, in botany: A genus of the monogynia order, belonging to the diandria claſs of plants; and in the natural method ranking under the 42d order, *Verticillatæ*. The corolla is unequal, with the upper lip linear, involving the filaments; there are four ſeeds. The moſt remarkable ſpecies is the zeylanica, a native of the Eaſt Indies. It riſes with an herbaceous, four cornered, hoary ſtalk, and bears leaves that are entire, nearly heart-ſhaped, woolly, deep notched on the edges, and having foot-ſtalks. The flowers, which are purpliſh and fragrant, ſurround the ſtalk in whorls, each whorl containing about 14 flowers; and are ſucceeded by four ſmall kidney-

kidney-ſhaped ſhining ſeeds, lodged in the bottom of the permanent flower-cup. The Indians ſuperſtitiouſly believe that a fumigation of this plant is effectual for driving away the devil; and from this imaginary property its name in the Ceyloneſe language is derived. Grimmius relates, in his *Laboratorium Ceylonicum*, that for taſte and ſmell this ſpecies of horehound ſtands remarkably diſtinguiſhed. A water and ſubtile oil are obtained from it, both of which are greatly commended in obſtructions of the matrix. A ſyrup is likewiſe prepared from this plant, which is uſeful in the above-mentioned diſorders as well as in diſeaſes of the ſtomach.

MONARDES (Nicholas), an excellent Spaniſh phyſician of Seville, who lived in the 16th century: and deſervedly acquired great reputation by his practical ſkill and the books which he wrote. His Spaniſh works have been tranſlated into Latin by Cluſius, into Italian by Annibal Brigantus, and thoſe upon American drugs have appeared in Engliſh. He died about the year 1578.

MONASTEREVAN, a poſt town of Ireland, in the county of Kildare and province of Leinſter, 36 miles from Dublin. This town takes its name from a magnificent abbey which was founded here, in which St Evan in the beginning of the 7th century placed a number of monks from ſouth Munſter, and which had the privilege of being a ſanctuary. St Evan's feſtival is held on the 22d of December. The conſecrated bell, which belonged to this ſaint, was on ſolemn trials ſworn upon by the whole tribe of the Eoganachts, and was always committed to the care of the Mac Evans, hereditary chief juſtices of Munſter; the abbot of this houſe ſat as a baron in parliament.—At the general ſuppreſſion of monaſteries, this abbey was granted to George Lord Audley, who aſſigned it to Adam Loftus, viſcount Ely. It afterwards came into the family of Moor, earls of Drogheda, and has been beautifully repaired by the preſent Lord Drogheda, ſtill wearing the venerable appearance of an abbey. There is a nurſery at Monaſterevan for the charter ſchools of the province of Leinſter; and the grand canal has been carried up to this town from Dublin, ſince which it has been much improved and enlarged with ſeveral new buildings. It is a market-town, and alſo holds four fairs in the year.

MONASTERY, a convent or houſe built for the reception of religious; whether it be abbey, priory, nunnery, or the like.

Monastery is only properly applied to the houſes of monks, mendicant friars, and nuns. The reſt are more properly called *religious houſes*. For the origin of monaſteries, ſee Monastic and Monk.

The houſes belonging to the ſeveral religious orders which obtained in England and Wales were, cathedrals, colleges, abbeys, priories, preceptories, commandries, hoſpitals, friaries, hermitages, chantries, and free chapels. Theſe were under the direction and management of various officers. The diſſolution of houſes of this kind began ſo early as the 1312, when the Templars were ſuppreſſed; and in 1323 their lands, churches, advowſons, and liberties, here in England, were given by 17 Ed. II. ſt. 3. to the prior and brethren of the hoſpital of St John at Jeruſalem. In the years 1390, 1437, 1441, 1459, 1497, 1505, 1508, and 1515, ſeveral other houſes were diſſolved, and their revenues ſettled on different colleges in Oxford and Cambridge. Soon after the laſt period, Cardinal Wolſey, by licence of the king and pope, obtained a diſſolution of above 30 religious houſes for the founding and endowing his colleges at Oxford and Ipſwich. About the ſame time a bull was granted by the ſame pope to Cardinal Wolſey to ſuppreſs monaſteries, where there were not above ſix monks, to the value of 8000 ducats a-year, for endowing Windſor and King's College in Cambridge; and two other bulls were granted to Cardinals Wolſey and Campeius, where there were leſs than twelve monks, and to annex them to the greater monaſteries; and another bull to the ſame cardinals to inquire about abbeys to be ſuppreſſed in order to be made cathedrals. Although nothing appears to have been done in conſequence of theſe bulls, the motive which induced Wolſey and many others to ſuppreſs theſe houſes was the deſire of promoting learning; and Archbiſhop Cranmer engaged in it with a view of carrying on the Reformation. There were other cauſes that concurred to bring on their ruin: many of the religious were looſe and vicious; the monks were generally thought to be in their hearts attached to the pope's ſupremacy; their revenues were not employed according to the intent of the donors; many cheats in images, feigned miracles, and counterfeit relics, had been diſcovered, which brought the monks into diſgrace; the Obſervant friars had oppoſed the king's divorce from Queen Catherine; and theſe circumſtances operated, in concurrence with the king's want of a ſupply and the people's deſire to ſave their money, to forward a motion in parliament, that in order to ſupport the king's ſtate and ſupply his wants, all the religious houſes might be conferred upon the crown which were not able to ſpend above L. 200 a-year; and an act was paſſed for that purpoſe 27 Hen. VIII. c. 28. By this act about 380 houſes were diſſolved, and a revenue of L.30,000 or L.32,000 a-year came to the crown; beſides about L.100,000 in plate and jewels. The ſuppreſſion of theſe houſes occaſioned diſcontent, and at length an open rebellion: when this was appeaſed, the king reſolved to ſuppreſs the reſt of the monaſteries, and appointed a new viſitation; which cauſed the greater abbeys to be ſurrendered apace; and it was enacted by 31 Hen. VIII. c. 13. that all monaſteries, &c. which have been ſurrendered ſince the 4th of February, in the 27th year of his majeſty's reign, and which hereafter ſhall be ſurrendered, ſhall be veſted in the king. The knights of St John of Jeruſalem were alſo ſuppreſſed by the 32 Hen. VIII. c. 24. The ſuppreſſion of theſe greater houſes by theſe two acts produced a revenue to the king of above L. 100,000 a-year, beſides a large ſum in plate and jewels. The laſt act of diſſolution in this king's reign was the act of 37 Hen. VIII. c. 4. for diſſolving colleges, free chapels, chantries, &c. which act was farther enforced by 1 Edw. VI. c. 14. By this act were ſuppreſſed 90 colleges, 110 hoſpitals, and 2374 chantries and free chapels. The number of houſes and places ſuppreſſed from firſt to laſt, ſo far as any calculations appear to have been made, ſeems to be as follow:

Of leffer monafteries, of which we have the valuation,	374
Of greater monafteries,	186
Belonging to the hofpitallers,	48
Colleges,	90
Hofpitals,	110
Chantries and free chapels,	2374
Total	3182

Befides the friars houfes and thofe fuppreffed by Wolfey, and many fmall houfes of which we have no particular account.

The fum total of the clear yearly revenue of the feveral houfes at the time of their diffolution, of which we have any account, feems to be as follows:

Of the greater monafteries,	L. 104,919	13	3½
Of all thofe of the leffer monafteries of which we have the valuation,	29,702	1	10½
Knights hofpitallers head houfe in London,	2385	12	8
We have the valuation of only 28 of their houfes in the country,	3026	9	5
Friars houfes of which we have the valuation,	751	2	0¼
Total	L. 140,784	19	3¼

If proper allowances are made for the leffer monafteries and houfes not included in this eftimate, and for the plate, &c. which came into the hands of the king by the diffolution, and for the value of money at that time, which was at leaft fix times as much as at prefent, and alfo confider that the eftimate of the lands was generally fuppofed to be much under the real worth, we muft conclude their whole revenues to have been immenfe.

It does not appear that any computation hath been made of the number of perfons contained in the religious houfes.

Thofe of the leffer monafteries diffolved by 27 Hen. VIII. were reckoned at about	10,000
If we fuppofe the colleges and hofpitals to have contained a proportionable number, thefe will make about	5347
If we reckon the number in the greater monafteries, according to the proportion of their revenues, they will be about 35,000; but as probably they had larger allowances in proportion to their number than thofe of the leffer monafteries, if we abate upon that account 5000, they will then be	30,000
One for each chantry and free chapel,	2374
Total	47,721

But as there were probably more than one perfon to officiate in feveral of the free chapels, and there were other houfes which are not included within this calculation, perhaps they may be computed in one general eftimate at about 50,000. As there were penfions paid to almoft all thofe of the greater monafteries, the king did not immediately come into the full enjoyment of their whole revenues: however, by means of what he did receive, he founded fix new bifhoprics, viz. thofe of Weftminfter (which was changed by Queen Elifabeth into a deanery, with twelve prebends and a fchool), Peterborough, Chefter, Gloucefter, Briftol, and Oxford. And in eight other fees he founded deaneries and chapters, by converting the priors and monks into deans and prebendaries, viz. Canterbury, Winchefter, Durham, Worcefter, Rochefter, Norwich, Ely, and Carlifle. He founded alfo the colleges of Chrift-church in Oxford and Trinity in Cambridge, and finifhed King's college there. He likewife founded profefforfhips of divinity, law, phyfic, and of the Hebrew and Greek tongues, in both the faid univerfities. He gave the houfe of Grey-friars and St Bartholomew's hofpital to the city of London, and a perpetual penfion to the poor knights of Windfor, and laid out great fums in building and fortifying many ports in the channel. It is obfervable, upon the whole, that the diffolution of thefe houfes was an act, not of the church, but of the ftate; in the period preceding the Reformation, by a king and parliament of the Roman catholic communion in all points except the king's fupremacy; to which the pope himfelf, by his bulls and licences, had led the way.

MONASTIC, fomething belonging to monks, or the monkifh life. The monaftic profeffion is a kind of civil death, which in all worldly matters has the fame effect with the natural death. The council of Trent, &c. fix fixteen years for the age at which a perfon may be admitted into the monaftical ftate.

St Antony is the perfon who, in the fourth century, firft inftituted the monaftic life; as St Pachomius, in the fame century, is faid to have firft fet on foot the cœnobitic life, *i. e.* regular communities of religious. In a fhort time the defarts of Egypt became inhabited with a fet of folitaries, who took upon them the monaftic profeffion. St Bafil carried the monkifh humour into the eaft, where he compofed a rule which afterwards obtained through a great part of the weft.

In the 11th century the monaftic difcipline was grown very remifs. St Odo firft began to retrieve it in the monaftery of Cluny: that monaftery, by the conditions of its erection, was put under the immediate protection of the holy fee; with a prohibition to all powers, both fecular and ecclefiaftical, to difturb the monks in the poffeffion of their effects or the election of their abbot. In virtue hereof they pleaded an exemption from the jurifdiction of the bifhop, and extended this privilege to all the houfes dependent on Cluny. This made the firft congregation of feveral houfes under one chief immediately fubject to the pope, fo as to conftitute one body, or, as they now call it, one *religious order*. Till then, each monaftery was independent and fubject to the bifhop. See MONK.

MONCAON, or MONZON, a town of Portugal, in the province of Entre-Douro-de-Minho, with a ftrong caftle. The Spaniards have feveral times attempted to take it, but in vain. W. Long. 8. 2. N. Lat. 41. 52.

MONCON, or MONZON, a ftrong town of Spain, in the kingdom of Arragon. It was taken by the French in 1642, but the Spaniards retook it the following year. It is feated at the confluence of the rivers Sofa and Cinca. E. Long. 0. 19. N. Lat. 41. 43.

MONCRIF (François Auguftin Paradis de), fecretary

Moncrif, Monda.

cretary to M. le comte de Clermont, reader to the queen, one of the 40 of the French academy, and a member of the academies of Nanci and Berlin, was born at Paris of reſpectable parents A. D. 1687, and died there Nov. 12. 1770, aged 83.

Avec des mœurs dignes de l'age d'or,
Il fut un ami ſur, un auteur agréable ;
Il mourut vieux comme Neſtor,
Mais il fut moins bavard et beaucoup plus aimable.

Such was Moncrif. He poſſeſſed an elegant mind, an engaging perſon, an unceaſing deſire to pleaſe, and a gentle, equable, and obliging temper. The advantage of reading in a very ſuperior and intereſting manner, of ſinging tender airs, and of compoſing agreeable couplets, ſoon procured him a great number of friends, and many of theſe of the firſt rank. He aſked permiſſion to accompany a celebrated miniſter who was baniſhed in 1757 ; but though ſuch diſintereſted attachment was highly admired, he was only allowed to go every year to expreſs his gratitude to him in his retreat. He was never aſhamed of the poverty of his relations, but aſſiſted them and brought them forward by his influence at court. He had been at firſt a fencing-maſter ; and it is ſaid that he foreſaw he would be obliged to employ his ſword in defence of his works. Moſt of them needed not this precaution. The principal are, 1. *Eſſai ſur la neceſſitè et ſur les moyens de plaire*, in 12mo. This production is written in a lively ingenious manner, is full of excellent maxims, and has gone through many editions. In the preſent age, a greater ſhare of argument would be expected ; but the chief merit of the work is, that, unlike the productions of many moraliſts, it contains nothing which the author himſelf did not reduce to practice. He had made it his ſtudy to contribute to the delight and amuſement of thoſe reſpectable ſocieties into which he was admitted. 2. *Les Ames rivales*, an agreeable little romance, in which there occur ſeveral ingenious obſervations on French manners ; the *Abderites*, a comedy of but ordinary merit ; *Poeſies diverſes*, full of delicacy (his *Romances* and his *Rajeuniſſement inutile* are particularly diſtinguiſhed for ſmooth verſification, elegant reflections, and pleaſing narration) ; and ſome diſſertations which diſplay conſiderable wit and information. Theſe pieces are to be found in the miſcellaneous works of the author, publiſhed at Paris 1743, in 12mo. 3. Some little pieces of one act ; which make part of different operas, called the *Fragmens, Zelindor, Iſmene Almaſis*, the *Genies tutelaires*, and the *Sibylle.* He was devoted to lyric poetry, and cultivated it with ſucceſs. In this ſpecies of writing we have from his pen the *Empire de l'Amour*, a ballet; the *Tropheé ;* the *Ames reunis*, a ballet which was never acted ; and *Eroſine*, a heroic paſtoral. 4. *L'Hiſtoire des Chats*, a trifling performance, too ſeverely cenſured at the time, and now almoſt wholly fallen into oblivion. This work gave the Comte d'Argenſon an opportunity of being witty at the author's expence. When Voltaire retired into Pruſſia, Moncrif applied to the miniſter for the vacant place of hiſtoriographer: " *Hiſtoriographe!* (ſaid the Comte d'Argenſon), vous voulez ſans doute dire hiſtoriogriphe." His works were collected, in 1761, into 4 vols, 12mo.

MONDA, or MUNDA (anc. geog.), a river of Luſitania, running midway from eaſt to weſt into the Atlantic, between the Durius and Tagus, and waſhing Conimbrica. Now the *Mondego*, a river of Portugal, which running by Coimbra, falls into the Atlantic, 30 miles below it.

MONDAY, the ſecond day of the week, ſo called as being anciently ſacred to the moon ; *q. d.* moon-day.

MONDOVI, a conſiderable town of Italy, in Piedmont ; with a citadel, univerſity, and biſhop's ſee. It is the largeſt and moſt populous town of Piedmont, and is ſeated in E. Long. 8. 15. N. Lat. 44. 23.

MONEMUGI, an empire in the ſouth of Africa, has Zanguebar on the eaſt, Monomotapa on the ſouth, Motamba and Makoko on the weſt, and Abyſſinia on the north and partly to the eaſt, though its boundaries that way cannot be aſcertained. It is divided into the kingdoms of Mujaco, Makoko or Anſiko, Gingiro, Cambate, Alaba, and Monemugi Proper. This laſt lies in the middle of the torrid zone, and about the equinoctial line ſouth of Makoko, weſt of Zanguebar, north of Monomotopa, and eaſt of Congo and of the northern parts of Monomotopa. To aſcertain its extent, is too difficult a taſk, being a country ſo little frequented. The country known, abounds with gold, ſilver, copper mines, and elephants. The natives clothe themſelves in ſilks and cottons, which they buy of ſtrangers, and wear collars of tranſparent amber-beads, brought them from Cambaya ; which beads ſerve alſo inſtead of money ; gold and ſilver being too common, and of little value among them.

Their monarch always endeavours to be at peace with the princes round about him, and to keep an open trade with Quitoa, Melinda, and Mombaza, on the eaſt, and with Congo on the weſt; from all which places the black merchants reſort thither for gold. The Portugueſe merchants report, that on the eaſt ſide of Monemugi there is a great lake full of ſmall iſlands, abounding with all ſorts of fowl and cattle, and inhabited by negroes. They relate alſo, that on the main-land eaſtward they heard ſometimes the ringing of bells, and that one could obſerve buildings very much like churches ; and that from theſe parts came men of a brown and tawny complexion, who traded with thoſe iſlanders, and with the people of Monemugi.

This country of Monemugi affords alſo abundance of palm-wine and oil, and ſuch great plenty of honey, that above half of it is loſt, the blacks not being able to conſume it. The air is generally very unwholeſome, and exceſſively hot, which is the reaſon why no Chriſtians undertake to travel in this empire. De Liſle gives the diviſion of this country as follows: The Maracates, the Meſſeguaries, the kingdom of the Buengas, the kingdom of Maſti, and that of Maravi. But we are not acquainted with any particulars relating to theſe nations or kingdoms

MONETARIUS, or MONEYER, a name which antiquaries and medaliſts give to thoſe who ſtruck the ancient coins or monies.

Many of the old Roman, &c. coins have the name of the *monetarius*, either written at length or at leaſt the initial letters of it. See MEDAL.

MONEY,

Money. MONEY, a piece of matter, commonly metal, to which public authority has affixed a certain value and weight to ferve as a medium in commerce. See COIN, COMMERCE, and MEDALS; alfo the article BANK.

Money is ufually divided into *real* or *effective*, and *imaginary* or *money of account*.

I. *REAL Money*.

1. *Hiftory of real Money*. Real money includes all coins, or fpecies of gold, filver, copper, and the like; which have courfe in common, and do really exift. Such are guineas, piftoles, pieces of eight, ducats, &c.

Real money, civilians obferve, has three effential qualities, *viz.* matter, form, and weight or value.

For the matter, copper is that thought to have been firft coined; afterwards filver; and laftly gold, as being the moft beautiful, fcarce, cleanly, divifible, and pure of all metals.

The degrees of goodnefs are expreffed in gold by carats; and in filver by pennyweights, &c. For there are feveral reafons for not coining them pure and without alloy, *viz.* the great lofs and expence in refining them, the neceffity of hardening them to make them more durable, and the fcarcity of gold and filver in moft countries. See ALLOY.

Among the ancient Britons, iron rings, or, as fome fay, iron plates, were ufed for money; among the Lacedemonians, iron bars quenched with vinegar, that they might not ferve for any other ufe. Seneca obferves, that there was anciently ftamped money of leather, *corium forma publica impreffum*. And the fame thing was put in practice by Frederic II. at the fiege of Milan; to fay nothing of an old tradition among ourfelves, that in the confufed times of the barons wars the like was done in England: but the Hollanders, we know, coined great quantities of pafteboard in the year 1574.

As to the form of money, it has been more various than the matter. Under this are comprehended the weight, figure, impreffion, and value.

For the impreffion, the Jews, though they detefted images, yet ftamped on the one fide of their fhekel the golden pot which had the manna, and on the other Aaron's rod. The Dardans ftamped two cocks fighting. The Athenians ftamped their coins with an owl, or an ox; whence the proverb on bribed lawyers, *Bos in lingua*. They of Ægina, with a tortoife; whence that other faying, *Virtutem et fapientiam vincunt teftudines*. Among the Romans, the monetarii fometimes impreffed the images of men that had been eminent in their families on the coins: but no living man's head was ever ftamped on a Roman coin till after the fall of the commonwealth. From that time they bore the emperor's head on one fide. From this time the practice of ftamping the prince's image on coins has obtained among all civilized nations; the Turks and other Mahometans alone excepted, who, in deteftation of images, infcribe only the prince's name, with the year of the tranfmigration of their prophet.

As to the figure, it is either round, as in Britain; multangular or irregular, as in Spain; fquare, as in fome parts of the Indies; or nearly globular, as in moft of the reft.

After the arrival of the Romans in this ifland, the Britons imitated them, coining both gold and filver with the images of their kings ftamped on them. When the Romans had fubdued the kings of the Britons, they alfo fuppreffed their coins, and brought in their own; which were current here from the time of Claudius to that of Valentinian the younger, about the fpace of 500 years.

Mr Camden obferves, that the moft ancient Englifh coin he had known was that of Ethelbert king of Kent, the firft Chriftian king in the ifland; in whofe time all money-accounts begin to pafs by the names of *pounds*, *fhillings*, *pence*, and *mancufes*. Pence feems borrowed from the Latin *pecunia*, or rather from *pendo*, on account of its juft weight, which was about threepence of our money. Thefe were coarfely ftamped with the king's image on the one fide, and either the mintmafter's, or the city's where it was coined, on the other. Five of thefe pence made their fchilling, probably fo called from *fcilingus*, which the Romans ufed for the fourth part of an ounce. Forty of thefe fcillings made their pound; and 400 of thefe pounds were a legacy, or a portion for a king's daughter, as appears by the laft will of king Alfred. By thefe names they tranflated all fums of money in their old Englifh teftament; talents by *pundes*; Judas's thirty pieces of filver by *thirtig fcillinga*; tribute-money, by *penining*; the mite by *feorthling*.

But it muft be obferved, they had no other real money, but pence only; the reft being imaginary moneys, *i. e.* names of numbers or weights. Thirty of thefe pence made a mancus, which fome take to be the fame with a mark; manca, as appears by an old MS. was *quinta pars unciæ*. Thefe mancas or mancufes were reckoned both in gold and filver. For in the year 680 we read that Ina king of the Weft Saxons obliged the Kentifhmen to buy their peace at the price of 30,000 mancas of gold. In the notes on King Canute's laws, we find this diftinction, that *mancufa* was as much as a mark of filver; and *manca* a fquare piece of gold, valued at 30 pence.

The Danes introduced a way of reckoning money by ores, *per oras*, mentioned in Domefday-book; but whether they were a feveral coin, or a certain fum, does not plainly appear. This, however, may be gathered from the Abbey-book of Burton, that 20 ores were equivalent to two marks. They had alfo a gold coin called *byzantine*, or *bezant*, as being coined at Conftantinople, then called *Byzantium*. The value of which coin is not only now loft, but was fo entirely forgot even in the time of King Edward III. that whereas the bifhop of Norwich was fined a bizantine of gold to be paid the abbot of St Edmund's Bury for infringing his liberties (as it had been enacted by parliament in the time of the conqueror), no man then living could tell how much it was: fo it was referred to the king to rate how much he fhould pay. Which is the more unaccountable, becaufe but 100 years before, 200,000 bezants were exacted by the foldan for the ranfom of St Louis of France; which were then valued at 100,000 livres.

Though the coining of money be a fpecial prerogative of the king, yet the ancient Saxon princes communicated it to their fubjects; infomuch that in every good town there was at leaft one mint; but at London

Money. don eight; at Canterbury four for the king, two for the archbishop, one for the abbot at Winchester, six at Rochester, at Hastings two, &c.

The Norman kings continued the same custom of coining only pence, with the prince's image on one side, and on the other the name of the city where it was coined, with a cross so deeply impressed, that it might be easily parted and broke into two halves, which, so broken, they called *halfpence*; or into four parts, which they called *fourthings* or *farthings*.

In the time of King Richard I. money coined in the east parts of Germany came in special request in England on account of its purity, and was called *easterling money*, as all the inhabitants of those parts were called *Easterlings*. And shortly after, some of those people skilled in coining were sent for hither, to bring the coin to perfection; which since has been called *sterling* for *Easterling*. See STERLING.

King Edward I. who first adjusted the measure of an ell by the length of his arm, herein imitating Charles the Great, was the first also who established a certain standard for the coin, which is expressed to this effect by Greg. Rockley, mayor of London, and mint-master.—"A pound of money containeth twelve ounces: in a pound there ought to be eleven ounces, two eastcilings, and one farthing; the rest alloy. The said pound ought to weigh twenty shillings and three pence in account and weight. The ounce ought to weigh twentypence, and a penny twenty-four grains and a half. Note, that eleven ounces two-pence Sterling ought to be of pure silver, called *leaf-silver*; and the minter must add of other weight seventeen-pence half-penny farthing, if the silver be so pure."

About the year 1320, the states of Europe first began to coin gold; and among the rest, our King Edward III. The first pieces he coined were called *florences*, as being coined by Florentines; afterwards he coined nobles; then rose-nobles, current at 6s. and 8d. half-nobles called *half-pennies*, at 3s. and 4d. of gold; and quarters at 20d. called *farthings of gold*. The succeeding kings coined rose-nobles, and double rose-nobles, great sovereigns, and half Henry nobles, angels, and shillings.

King James I. coined units, double crowns, Britain crowns; then crowns, half-crowns, &c.

2. *Comparative value of Money and Commodities at different periods*. The English money, though the same names do by no means correspond with the same quantity of precious metal as formerly, has not changed so much as the money of most other countries. From the time of William the Conqueror, the proportion between the pound, the shilling, and the penny, seems to have been uniformly the same as at present.

Edward III. as already mentioned, was the first of our Kings that coined any gold; and no copper was coined by authority before James I. These pieces were not called farthings, but *farthing tokens*, and all people were at liberty to take or refuse them. Before the time of Edward III. gold was exchanged, like any other commodity, by its weight; and before the time of James I. copper was stamped by any one person who chose to do it.

In the year 712 and 727, an ewe and lamb were rated at 1s. Saxon money till a fortnight after Easter. Between the years 900 and 1000, two hydes of land, each containing about 120 acres, were sold for 100 shillings. In 1000, by King Ethelred's laws, a horse was rated at 30s. a mare, or a colt of a year old, at 20s. a mule, or young ass, at 12s. an ox at 30s. a cow at 24s. a swine at 8d. a sheep at 1s. In 1043, a quarter of wheat was sold for 60d. Hence it is computed, that in the Saxon times there was ten times less money, in proportion to commodities, than at present. Their nominal specie, therefore, being about three times higher than ours, the price of every thing, according to our present language, must be reckoned thirty times cheaper than it is now.

In the reign of William the Conqueror, commodities were ten times cheaper than they are at present; from which we cannot help forming a very high idea of the wealth and power of that king: for his revenue was L. 400,000 per annum, every pound being equal to that weight of silver, consequently the whole may be estimated at L. 1,200,000 of the present computation; a sum which, considering the different value of money between that period and the present, was equivalent to L. 12,000,000 of modern estimation.

The most necessary commodities do not seem to have advanced their price from William the Conqueror to Richard I.

The price of corn in the reign of Henry III. was near half the mean price in our times. Bishop Fleetwood has shown, that in the year 1240, which was in this reign L. 4 : 13 : 9, was worth about L. 50 of our present money. About the latter end of this reign, Robert de Hay, rector of Souldern, agreed to receive 100s. to purchase to himself and successor the annual rent of 5s. in full compensation of an acre of corn.

Butchers meat, in the time of the great scarcity in the reign of Edward II. was, by a parliamentary ordinance, sold three times cheaper than our mean price at present; poultry somewhat lower, because being now considered as a delicacy, it has risen beyond its proportion. The mean price of corn at this period was half the present value, and the mean price of cattle one-eighth.

In the next reign, which was that of Edward III. the most necessary commodities were in general about three or four times cheaper than they are at present.

In these times, knights, who served on horseback in the army, had 2s. a-day, and a foot archer 6d. which last would now be equal to a crown a day. This pay has continued nearly the same nominally (only that in the time of the commonwealth the pay of the horse was advanced to 2s. 6d. and that of the foot 1s. though it was reduced again at the Restoration), but soldiers were proportionably of a better rank formerly.

In the time of Henry VI. corn was about half its present value, other commodities much cheaper. Bishop Fleetwood has determined, from a most accurate consideration of every circumstance, that L. 3 in this reign was equivalent to L. 28 or L. 30 now.

In the time of Henry VII. many commodities were three times as cheap here, and in all Europe, as they are at present, there having been a great increase of gold and silver in Europe since his time, occasioned by the discovery of America.

The

Money.

The commodities whose price has rifen the moft fince before the time of Henry VII. are butchers meat, fowls, and fifh, efpecially the latter. And the reafon why corn was always much dearer in proportion to other eatables, according to their prices at prefent, is, that in early times agriculture was little underftood. It required more labour and expence, and was more precarious, than it is at prefent. Indeed, notwithftanding the high price of corn in the times we are fpeaking of, the raifing of it fo little anfwered the expence, that agriculture was almoft univerfally quitted for grafing; which was more profitable, notwithftanding the low price of butchers meat. So that there was conftant occafion for ftatutes to reftrain grafing, and to promote agriculture; and no effectual remedy was found till the bounty upon the exportation of corn; fince which, above ten times more corn has been raifed in this country than before.

The price of corn in the time of James I. and confequently that of other neceffaries of life, was not lower, but rather higher, than at prefent: wool is not two thirds of the value it was then; the finer manufactures having funk in price by the progrefs of art and induftry, notwithftanding the increafe of money. Butchers meat was higher than at prefent. Prince Henry made an allowance of near 4d. per pound for all the beef and mutton ufed in his family. This may be true with refpect to London; but the price of butchers meat in the country, which does not even now much exceed this price at a medium, has certainly greatly increafed of late years, and particularly in the northern counties.

The prices of commodities are higher in England than in France; befides that the poor people of France live upon much lefs than the poor in England, and their armies are maintained at lefs expence. It is computed by Mr Hume, that a Britifh army of 20,000 men is maintained at near as great an expence as 60,000 in France, and that the Englifh fleet, in the war of 1741, required as much money to fupport it as all the Roman legions in the time of the emperors. However, all that we can conclude from this is, that money is much more plentiful in Europe at prefent than it was in the Roman empire.

In the 13th century the common intereft which the Jews had for their money, Voltaire fays, was 20 per cent. But with regard to this, we muft confider the great contempt that nation was always held in, the large contributions they were frequently obliged to pay, the rifk they run for never receiving the principal, the frequent confifcations of all their effects, and the violent perfecutions to which they were expofed; in which circumftances it was impoffible for them to lend money at all unlefs for moft extravagant intereft, and much difproportioned to its real value. Before the difcovery of America and the plantation of our colonies, the intereft of money was generally 12 per cent. all over Europe; and it has been growing gradually lefs fince that time, till it is now generally about four or five.

When fums of money are faid to be raifed by a whole people, in order to form a juft eftimate of it, we muft take into confideration not only the quantity of the precious metal according to the ftandard of the coin, and the proportion of the quantity of coin to the commodities, but alfo the number and riches of the people who raife it: for populous and rich countries will much more eafily raife any certain fum of money than one that is thinly inhabited, and chiefly by poor people. This circumftance greatly adds to our furprife at the vaft fums of money raifed by William the Conqueror, who had a revenue nearly in value equal to L. 12,000,000 of our money (allowance being made for the ftandard of coin and the proportion it bore to commodities), from a country not near fo populous or rich as England is at prefent. Indeed, the accounts hiftorians give us of the revenues of this prince, and the treafure he left behind him, are barely credible.

II. *Imaginary Money*, or *Money of Account*, is that which has never exifted, or at leaft which does not exift in real fpecie, but is a denomination invented or retained to facilitate the ftating of accounts, by keeping them ftill on a fixed footing, not to be changed, like current coins, which the authority of the fovereign raifes or lowers according to the exigencies of the ftate. Of which kind are pounds, livres, marks, mar avedies, &c. See the annexed Table, where the fictitious money is diftinguifhed by a dagger (†).

Moneys of Account among the Ancients.—1. The Grecians reckoned their fums of money by *drachma*, *minæ*, and *talenta*. The drachma was equal to $7\frac{3}{4}$ d. Sterling; 100 drachmæ made the mina, equal to 3*l.* 4*s.* 7*d.* Sterling; 60 minæ made the talent, equal to 193*l.* 15*s.* Sterling: hence 100 talents amounted to 19,375*l.* Sterling. The mina and talentum, indeed, were different in different provinces: their proportions in Attic drachms are as follow. The Syrian mina contained 25 Attic drachms; the Ptolemaic $33\frac{1}{3}$; the Antiochic and Eubæan 100; the Babylonic 116; the greater Attic and Tyrian $133\frac{1}{3}$; the Æginean and Rhodian $166\frac{2}{3}$. The Syrian talent contained 15 Attic minæ; the Ptolemaic 20; the Antiochic 60; the Eubæan 60; the Babylonic 70; the greater Attic and Tyrian 80; the Æginean and Rhodian 100.

2. Roman moneys of account were the *feftertius* and *feftertium*. The feftertius was equal to 1*d.* $3\frac{3}{4}$*q.* Sterling. One thoufand of thefe made the feftertium, equal to 8*l.* 1*s.* 5*d.* 2*q.* Sterling. One thoufand of thefe feftertia made the decies feftertium (the adverb *centies* being always underftood) equal to 8072*l.* 18*s.* 4*d.* Sterling. The decies feftertium they alfo called *decies centena millia nummum*. Centies feftertium, or centies HS, were equal to 80,729*l.* 3*s.* 4*d.* Millies HS to 807,291*l.* 13*s.* 4*d.* Millies centies HS to 888,020*l.* 16*s.* 8*d.*

Theory of Money.

1. *Of Artificial or Material Money.*

I. As far back as our accounts of the tranfactions of mankind reach, we find they had adopted the precious metals, that is, filver and gold, as the common meafure of value, and as the adequate equivalent for every thing alienable.

The metals are admirably adapted for this purpofe: they are perfectly homogeneous: when pure, their

Money. maffes, or bulks, are exactly in proportion to their weights: no phyfical difference can be found between two pounds of gold, or filver, let them be the production of the mines of Europe, Afia, Africa, or America: they are perfectly malleable, fufible, and fuffer the moft exact divifion which human art is capable to give them: they are capable of being mixed with one another, as well as with metals of a bafer, that is, of a lefs homogeneous nature, fuch as copper: by this mixture they fpread themfelves uniformly through the whole mafs of the compofed lump, fo that every atom of it becomes proportionally poffeffed of a fhare of this noble mixture; by which means the fubdivifion of the precious metals is rendered very extenfive.

Their phyfical qualities are invariable: they lofe nothing by keeping; they are folid and durable; and though their parts are feparated by friction, like every other thing, yet ftill they are of the number of thofe which fuffer leaft by it.

If money, therefore, can be made of any thing, that is, if the proportional value of things vendible can be meafured by any thing material, it may be meafured by the metals.

II. The two metals being pitched upon as the moft proper fubftances for realifing the ideal fcale of money, thofe who undertake the operation of adjufting a ftandard, muft conftantly keep in their eye the nature and qualities of a fcale, as well as the principles upon which it is formed.

The unit of the fcale muft conftantly be the fame, although realifed in the metals, or the whole operation fails in the moft effential part. This realifing the unit is like adjufting a pair of compaffes to a geometrical fcale, where the fmalleft deviation from the exact opening once given muft occafion an incorrect meafure. The metals, therefore, are to money what a pair of compaffes is to a geometrical fcale.

This operation of adjufting the metals to the money of account implies an exact and determinate proportoin of both metals to the money-unit, realifed in all the fpecies and denominations of coin, adjufted to that ftandard.

The fmalleft particle of either metal added to, or taken away from, any coins, which reprefent certain determinate parts of the fcale, overturns the whole fyftem of material money. And if, notwithftanding fuch variation, thefe coins continue to bear the fame denominations as before, this will as effectually deftroy their ufefulnefs in meafuring the value of things, as it would overturn the ufefulnefs of a pair of compaffes, to fuffer the opening to vary, after it is adjufted to the fcale reprefenting feet, toifes, miles or leagues, by which the diftances upon the plan are to be meafured.

III. Debafing the ftandard is a good term; becaufe it conveys a clear and diftinct idea. It is diminifhing the weight of the pure metal contained in that denomination by which a nation reckons, and which we have called the *money-unit*. Raifing the ftandard requires no farther definition, being the direct contrary.

IV. Altering the ftandard (that is, raifing or debafing the value of the money-unit) is like altering the national meafures or weights. This is beft difcovered by comparing the thing altered with things of the fame nature which have fuffered no alteration. Thus, if the foot of meafure was altered at once over all England, by adding to it, or taking from it, any proportional part of its ftandard length, the alteration would be beft difcovered by comparing the new foot with that of Paris, or of any other country, which had fuffered no alteration. Juft fo, if the pound Sterling, which is the Englifh unit, fhall be found any how changed, and if the variation it has met with be difficult to afcertain becaufe of a complication of circumftances, the beft way to difcover it, will be to compare the former and the prefent value of it with the money of other nations which has fuffered no variation. This the courfe of exchange will perform with the greateft exactnefs.

V. Artifts pretend, that the precious metals, when abfolutely pure from any mixture, are not of fufficient hardnefs to conftitute a folid and lafting coin. They are found alfo in the mines mixed with other metals of a bafer nature; and the bringing them to a ftate of perfect purity occafions an unneceffary expence. To avoid, therefore, the inconvenience of employing them in all their purity, people have adoped the expedient of mixing them with a determinate proportion of other metals, which hurts neither their fufibility, malleability, beauty, or luftre. This metal is called *alloy*; and, being confidered only as a fupport to the principal metal, is accounted of no value in itfelf. So that eleven ounces of gold, when mixed with one ounce of filver, acquires by that addition no augmentation of value whatever.

This being the cafe, we fhall, as much as poffible, overlook the exiftence of alloy, in fpeaking of money, in order to render language lefs fubject to ambiguity.

2. *Incapacities of the Metals to perform the Office of an invariable Meafure of Value.*

I. Were there but one fpecies of fuch a fubftance as we have reprefented gold and filver to be; were there but one metal poffeffing the qualities of purity, divifibility, and durability; the inconveniences in the ufe of it for money would be fewer by far than they are found to be as matters ftand.

Such a metal might then, by an unlimited divifion into parts exactly equal, be made to ferve as a tolerably fteady and univerfal meafure. But the rivalfhip between the metals, and the perfect equality which is found between all their phyfical qualities, fo far as regards purity and divifibility, render them fo equally well adapted to ferve as the common meafure of value, that they are univerfally admitted to pafs current as money.

What is the confequence of this? that the one meafures the value of the other, as well as that of every other thing. Now the moment any meafure begins to be meafured by another, whofe proportion to it is not phyfically, perpetually, and invariably the fame, all the ufefulnefs of fuch a meafure is loft. An example will make this plain.

A foot of meafure is a determinate length. An Englifh foot may be compared with the Paris foot, or with that of the Rhine; that is to fay, it may be meafured by them: and the proportion between their lengths

lengths may be expressed in numbers; which proportion will be the same perpetually. The measuring the one by the other will occasion no uncertainty; and we may speak of length by Paris feet, and be perfectly well understood by others who are used to measure by the English foot, or by the foot of the Rhine.

But suppose that a youth of 12 years old takes it into his head to measure from time to time, as he advances in age, by the length of his own foot, and that he divides this growing foot into inches and decimals: what can be learned from his account of measures? As he increases in years, his foot, inches, and subdivisions, will be gradually lengthening; and were every man to follow his example, and measure by his own foot, then the foot of a measure now established would totally cease to be of any utility.

This is just the case with the two metals. There is no determinate invariable proportion between their value; and the consequence of this is, that when they are both taken for measuring the value of other things, the things to be measured, like lengths to be measured by the young man's foot, without changing their relative proportion between themselves, change, however, with respect to the denominations of both their measures. An example will make this plain.

Let us suppose an ox to be worth 3000 pounds weight of wheat, and the one and the other to be worth an ounce of gold, and an ounce of gold to be worth exactly 15 ounces of silver: if the case should happen, that the proportional value between gold and silver should come to be as 14 is to 1, would not the ox, and consequently the wheat, be estimated at less in silver, and more in gold, than formerly? Farther, would it be in the power of any state to prevent this variation in the measure of the value of oxen and wheat, without putting into the unit of their money less silver and more gold than formerly?

If therefore any particular state should fix the standard of the unit of their money to one species of the metals, while in fact both the one and the other are actually employed in measuring value; does not such a state resemble the young man who measures all by his growing foot? For if silver, for example, be retained as the standard, while it is gaining upon gold one fifteenth additional value; and if gold continue all the while to determine the value of things as well as silver; it is plain, that, to all intents and purposes, this silver-measure is lengthening daily like the young man's foot, since the same weight of it must become every day equivalent to more and more of the same commodity; notwithstanding that we suppose the same proportion to subsist, without the least variation, between that commodity and every other species of things alienable.

Buying and selling are purely conventional, and no man is obliged to give his merchandise at what may be supposed to be the proportion of its worth. The use, therefore, of an universal measure, is to mark, not only the relative value of the things to which it is applied as a measure, but to discover in an instant the proportion between the value of those, and of every other commodity valued by a determinate measure in all the countries of the world.

Were pounds Sterling, livres, florins, piastres, &c. which are all money of account, invariable in their values, what a facility would it produce in all conversions, what an assistance to trade! But as they are all limited or fixed to coins, and consequently vary from time to time, this example shows the utility of the invariable measure which we have described.

There is another circumstance which incapacitates the metals from performing the office of money; the substance of which the coin is made, is a commodity which rises and sinks in its value with respect to other commodities, according to the wants, competition, and caprices of mankind. The advantage, therefore, found in putting an intrinsic value into that substance which performs the function of money of account, is compensated by the instability of that intrinsic value; and the advantage obtained by the stability of paper, or symbolical money, is compensated by the defect it commonly has of not being at all times susceptible of realization into solid property or intrinsic value.

In order, therefore, to render material money more perfect, this quality of metal, that is, of a commodity, should be taken from it; and in order to render paper-money more perfect, it ought to be made to circulate upon metallic or land-security.

II. There are several smaller inconveniences accompanying the use of the metals, which we shall here shortly enumerate.

1mo, No money made of gold or silver can circulate long, without losing its weight, although it all along preserves the same denomination. This represents the contracting a pair of compasses which had been rightly adjusted to the scale.

2do, Another inconvenience proceeds from the fabrication of money. Supposing the faith of princes who coin money to be inviolable, and the probity as well as capacity of those to whom they commit the inspection of the business of the metals to be sufficient, it is hardly possible for workmen to render every piece exactly of a proper weight, or to preserve the due proportion between pieces of different denominations; that is to say, to make every ten sixpences exactly of the same weight with every crown-piece and every five shillings struck in a coinage. In proportion to such inaccuracies, the parts of the scale become unequal.

3tio, Another inconvenience, and far from being inconsiderable, flows from the expence requisite for the coining of money. This expence adds to its value as a manufacture, without adding any thing to its weight.

4to, The last inconvenience is, that by fixing the money of account entirely to the coin, without having any independent common measure, (to mark and control these deviations from mathematical exactness, which are either inseparable from the metals themselves, or from the fabrication of them), the whole measure of value, and all the relative interests of debtors and creditors, become at the disposal not only of workmen in the mint, of Jews who deal in money, of clippers and washers in coin; but they are also entirely at the mercy of princes, who have the right of coinage, and who have frequently also the right of

raifing or debafing the ftandard of the coin, according as they find it moft for their prefent and temporary intereft.

3. *Methods which may be propofed for leffening the feveral Inconveniences to which Material Money is liable.*

The inconveniences from the variation in the relative value of the metals to one another, may in fome meafure be obviated by the following expedients.

1mo, By confidering one only as the ftandard, and leaving the other to feek its own value like any other commodity.

2do, By confidering one only as the ftandard, and fixing the value of the other from time to time by authority, according as the market-price of the metals fhall vary.

3tio, By fixing the ftandard of the unit according to the mean proportion of the metals, attaching it to neither; regulating the coin accordingly; and upon every confiderable variation in the proportion between them, either to make a new coinage, or to raife the denomination of one of the fpecies, and lower it in the other, in order to preferve the unit exactly in the mean proportion between the gold and filver.

4to, To have two units and two ftandards, one of gold and one of filver, and to allow every body to ftipulate in either.

5to, Or laft of all, to oblige all debtors to pay one half in gold, and one half in the filver ftandard.

4. *Variations to which the Value of the Money-unit is expofed from every Diforder in the Coin.*

Let us fuppofe, at prefent, the only diforder to confift in a want of the due proportion between the gold and filver in the coin.

This proportion can only be eftablifhed by the market-price of the metals; becaufe an augmentation and rife in the demand for gold or filver has the effect of augmenting the value of the metal demanded. Let us fuppofe, that to-day one pound of gold may buy fifteen pounds of filver: If to-morrow there be a high demand for filver, a competition among merchants to have filver for gold will enfue: they will contend who fhall get the filver at the rate of 15 pounds for one of gold: this will raife the price of it; and in proportion to their views of profit, fome will accept of lefs than the 15 pounds. This is plainly a rife in the filver, more properly than a fall in the gold; becaufe it is the competition for the filver which has occafioned the variation in the former proportion between the metals.

Let us now fuppofe, that a ftate, having with great exactnefs examined the proportion of the metals in the market, and having determined the precife quantity of each for realifing or reprefenting the money-unit, fhall execute a moft exact coinage of gold and filver coin. As long as that proportion continues unvaried in the market, no inconvenience can refult from that quarter in making ufe of metals for money of account.

But let us fuppofe the proportion to change: that the filver, for example, fhall rife in its value with regard to gold: will it not follow, from that moment, that the unit realized in the filver, will become of more value than the unit realized in the gold coin?

But as the law has ordered them to pafs as equivalents for one another, and as debtors have always the option of paying in what legal coin they think fit, will they not all choofe to pay in gold? and will not then the filver coin be melted down or exported, in order to be fold as bullion, above the value it bears when it circulates in coin? Will not this paying in gold alfo really diminifh the value of the money-unit, fince upon this variation every thing muft fell for more gold than before, as we have already obferved.

Confequently, merchandife, which have not varied in their relative value to any other thing but to gold and filver, muft be meafured by the mean proportion of the metals; and the application of any other meafure to them is altering the ftandard. If they are meafured by the gold, the ftandard is debafed; if by filver, it is raifed.

If, to prevent the inconvenience of melting down the filver, the ftate fhall give up affixing the value of their unit to both fpecies at once, and fhall fix it to one, leaving the other to feek its price as any other commodity; in that cafe, no doubt, the melting down of the coin will be prevented; but will this ever reftore the value of the money-unit to its former ftandard? Would it, for example, in the foregoing fuppofition, raife the debafed value of the money-unit in the gold coin, if that fpecies were declared to be the ftandard? It would indeed render filver coin purely a merchandife, and, by allowing it to feek its value, would certainly prevent it from being melted down as before; becaufe the pieces would rife conventionally in their denomination; or an *agio*, as it is called, would be taken in payments made in filver: but the gold would not, on that account, rife in its value, or begin to purchafe any more merchandife than before. Were therefore the ftandard fixed to the gold, would not this be an arbitrary and a violent revolution in the value of the money-unit, and a debafement of the ftandard?

If, on the other hand, the ftate fhould fix the ftandard to the filver, which we fuppofe to have rifen in its value, would that ever fink the advanced value which the filver coin had gained above the worth of the former ftandard unit? and would not this be a violent and an arbitrary revolution in the value of the money-unit, and a raifing of the ftandard?

The only expedient, therefore, is, in fuch a cafe, to fix the numerary unit to neither of the metals, but to contrive a way to make it fluctuate in a mean proportion between them; which is in effect the introduction of a pure ideal money of account.

The regulation of fixing the unit by the mean proportion, ought to take place at the inftant the ftandard unit is fixed with exactnefs both to the gold and filver. If it be introduced long after the market-proportion between the metals has deviated from the proportion eftablifhed in the coin; and if the new regulation is made to have a retrofpect, with regard to the acquitting of permanent contracts entered into while the value of the money-unit had attached itfelf to the loweft currency in confequence of the principle above laid

laid down; then the restoring the money-unit to that standard where it ought to have remained (to wit, to the mean proportion) is an injury to all debtors who have contracted since the time that the proportion of the metals began to vary.

This is clear from the former reasoning. The moment the market price of the metals differs from that in the coin, every one who has payments to make, pays in that species which is the highest rated in the coin; consequently, he who lends, lends in that species If after the contract, therefore, the unit is carried up to the mean proportion, this must be a loss to him who had borrowed.

From this we may perceive, why there is less inconvenience from the varying of the proportion of the metals, where the standard is fixed to one of them, than when it is fixed to both. In the first case, it is at least uncertain whether the standard or the merchandise species is to rise; consequently it is uncertain whether the debtors or the creditors are to gain by a variation. If the standard species should rise, the creditors will gain; if the merchandise species rises, the debtors will gain; but when the unit is attached to both species, then the creditors never can gain, let the metals vary as they will; if silver rises, then debtors will pay in gold; if gold rises, the debtors will pay in silver. But whether the unit be attached to one or to both species, the infallible consequence of a variation is, that one half of the difference is either gained or lost by debtors and creditors. The invariable unit is constantly the mean proportional between the two measures.

5. *How the Variations of the intrinsic Value of the Unit of Money must affect all the domestic Interest of a Nation.*

If the changing the content of the bushel by which grain is measured, would affect the interest of those who are obliged to pay, or who are entitled to receive, a certain number of bushels of grain for the rent of lands; in the same manner must every variation in the value of the unit of account affect all persons who, in permanent contracts, are obliged to make payments, or who are obliged to receive sums of money stipulated in multiples or in fractions of that money-unit.

Every variation, therefore, upon the intrinsic value of the money-unit, has the effect of benefiting the class of creditors at the expence of debtors, or *vice versa*.

This consequence is deduced from an obvious principle. Money is more or less valuable in proportion as it can purchase more or less of every kind of merchandise. Now, without entering anew into the causes of the rise and fall of prices, it is agreed upon all hands, that whether an augmentation of the general mass of money in circulation has the effect of raising prices in general, or not, any augmentation of the quantity of the metals appointed to be put into the money-unit, must at least affect the value of that money-unit, and make it purchase more of any commodity than before: that is to say, 113 grains of fine gold, the present weight of a pound Sterling in gold, can buy 113 pounds of flour; were the pound Sterling raised to 114 grains of the same metal, it would buy 114 pounds of flour; consequently, were the pound Sterling augmented by one grain of gold, every miller who paid a rent of ten pounds a year, would be obliged to sell 1140 pounds of his flour, in order to procure ten pounds to pay his rent, in place of 1130 pounds of flour, which he sold formerly to procure the same sum; consequently, by this innovation, the miller must lose yearly ten pounds of flour, which his master consequently must gain. From this example, it is plain, that every augmentation of metals put into the pound Sterling, either of silver or gold, must imply an advantage to the whole class of creditors who are paid in pounds Sterling, and consequently must be a proportional loss to all debtors who must pay by the same denomination.

6. *Of the Disorder in the British Coin, so far as it occasions the melting down or the exporting of the Specie.*

The defects in the British coin are three.

1mo, The proportion between the gold and silver in it is found to be as 1 to $15\frac{2}{10}$, whereas the market price may be supposed to be nearly as 1 to $14\frac{1}{2}$.

2do, Great part of the current money is worn and light.

3tio, From the second defect proceeds the third, to wit, that there are several currencies in circulation which pass for the same value, without being of the same weight.

4to, From all these defects results the last and greatest inconvenience, to wit, that some innovation must be made, in order to set matters on a right footing.

The English, besides the unit of their money which they call the pound Sterling, have also the unit of their weight for weighing the precious metals.

This is called the *pound troy*, and consists of 12 ounces, every ounce of 20 penny-weights, and every penny-weight of 24 grains. The pound troy, therefore, consists of 240 penny-weights and 5760 grains.

The fineness of the silver is reckoned by the number of ounces and penny-weights of the pure metal in the pound troy of the composed mass; or, in other words, the pound troy, which contains 5760 grains of standard silver, contains 5328 grins of fine silver, and 432 grains of copper, called *alloy*.

Thus standard silver is 11 ounces 2 penny-weights of fine silver in the pound troy to 18 penny-weights copper, or 111 parts fine silver to 9 parts alloy.

Standard gold is 11 ounces fine to 1 ounce silver or copper employed for alloy, which together make the pound troy; consequently, the pound troy of standard gold contains 5280 grains fine, and 480 grains alloy, which alloy is reckoned of no value.

This pound of standard silver is ordered, by statute of the 43d of Elizabeth, to be coined into 62 shillings, 20 of which make the pound sterling; consequently the 20 shillings contain 1718.7 grains of fine silver, and 1858.06 standard silver.

The pound troy of standard gold, $\frac{11}{12}$ fine, is ordered, by an act of king Charles II. to be cut into $44\frac{1}{2}$ guineas; that is to say, every guinea contains 129.43 grains of standard gold, and 118.644 of fine gold;

 and

Money. and the pound Sterling, which is $\frac{20}{21}$ of the guinea, contains 113.994, which we may ftate at 113 grains of fine gold.

The coinage in England is entirely defrayed at the expence of the ftate. The mint price for the metals is the very fame with the price of the coin. Whoever carries to the mint an ounce of ftandard filver, receives for it in filver coin 5 *s.* 2 *d.* or 62 *d.* : whoever carries an ounce of ftandard gold receives in gold coin 3*l.* 17*s.* 10$\frac{1}{2}$*d.* the one and the other making exactly an ounce of the fame finenefs with the bullion. Coin, therefore, can have no value in the market above bullion ; confequently, no lofs can be incurred by thofe who melt it down.

When the guinea was firft ftruck, the government (not inclining to fix the pound Sterling to the gold coin of the nation) fixed the guinea at 20 fhillings, (which was then below its proportion to the filver), leaving it to feek its own price above that value, according to the courfe of the market.

By this regulation no harm was done to the Englifh filver ftandard ; becaufe the guinea, or 118.644 grains fine gold being worth more, at that time, than 20 fhillings, or 1718.7 grains fine filver, no debtor would pay with gold at its ftandard value ; and whatever it was received for above that price was purely conventional.

Accordingly guineas fought their own price until the year 1728, that they were fixed a-new, not below their value as at firft, but as what was then reckoned their exact value, according to the proportion of the metals, *viz.* at 21 fhillings ; and at this they were ordered to pafs current in all payments.

This operation had the effect of making the gold a ftandard as well as the filver. Debtors then paid indifferently in gold as well as in filver, becaufe both were fuppofed to be of the fame intrinfic as well as current value ; in which cafe no inconvenience could follow upon this regulation. But in time filver came to be more demanded ; the making of plate began to prevail more than formerly, and the exportation of filver to the Eaft Indies increafing yearly, made the demand for it greater, or perhaps brought its quantity to be proportionally lefs than before. This changed the proportion of the metals ; and by flow degrees they have come from that of 1 to 15.2 (the proportion they were fuppofed to have when the guineas were fixed and made a lawful money at 21 fhillings) to that of 14.5, the prefent *fuppofed* proportion.

The confequence of this has been, that the fame guinea which was worth 1804.6 grains fine filver, at the time it was fixed at 21 s. is now worth more than 1719.9 grains of fine filver according to the proportion of 14$\frac{1}{2}$ to 1.

Confequently debtors, who have always the option of the legal fpecies in paying their debts, will pay pounds fterling no more in filver but in gold ; and as the gold pounds they pay in are not intrinfically worth the filver pounds they paid in formerly according to the ftatute of Elifabeth, it follows that the pound Sterling in filver is really no more the ftandard, fince nobody will pay at that rate, and fince nobody can be compelled to do it.

Befides this want of proportion between the metals, the filver coined before the reign of George I. is now become light by circulation ; and the guineas coined by all the princes fince Charles II. pafs by tale, though many of them are confiderably diminifhed in their weight.

Let us now examine what profit the want of proportion and the want of weight in the coin can afford to the money-jobbers in melting it down or exporting it.

Did every body confider coin only as the meafure for reckoning value, without attending to its value as a metal, the deviations of gold and filver coin from perfect exactnefs, either as to proportion or weight, would occafion little inconvenience.

Great numbers, indeed, in every modern fociety, confider coin in no other light than that of money of account ; and have great difficulty to comprehend what difference any one can find between a light fhilling and a heavy one, or what inconvenience there can poffibly refult from a guinea's being fome grains of fine gold too light to be worth 21 fhillings ftandard weight. And did every one think in the fame way, there would be no occafion for coin of the precious metals at all ; leather, copper, iron, or paper, would keep the reckoning as well as gold and filver.

But although there be many who look no farther than at the ftamp on the coin, there are others whofe fole bufinefs it is to examine its intrinfic worth as a commodity, and to profit of every irregularity in the weight and proportion of metals.

By the very inftitution of coinage, it is implied, that every piece of the fame metal, and fome denomination with regard to the money-unit, fhall pafs current for the fame value.

It is, therefore, the employment of money-jobbers, to examine, with a fcrupulous exactnefs, the precife weight of every piece of coin which comes into their hands.

The firft object of their attention is, the price of the metals in the market : a jobber finds, at prefent, that with 14.5 pounds of fine filver bullion, he can buy one pound of fine gold bullion.

He therefore buys up with gold coin all the new filver as faft as it is coined, of which he can get at the rate of 15.2 pounds for one in gold ; thefe 15.2 pounds filver coin he melts down into bullion, and converts that back into gold bullion, giving at the rate of only 14.5 pounds for one.

By this operation he remains with the value of $\frac{7}{10}$ of one pound weight of filver bullion clear profit upon the 15$\frac{1}{5}$ pounds he bought ; which $\frac{7}{10}$ is really loft by the man who inadvertently coined filver at the mint, and gave it to the money-jobber for his gold. Thus the ftate lofes the expence of the coinage, and the public the convenience of change for their guineas.

But here it may be afked, Why fhould the money-jobber melt down the filver coin ? can he not buy gold with it as well without melting it down ? He cannot ; becaufe when it is in coin he cannot avail himfelf of its being new and weighty. Coin goes by tale, not by weight ; therefore, were he to come to market with his new filver coin, gold bullion being fold at the mint price, we fhall fuppofe, viz. at 3*l.* 17*s.* 10$\frac{1}{2}$*d.* Sterling money *per* ounce, he would be obliged to pay the price of what he bought with heavy money, which he can equally do with light.

He therefore melts down the new filver coin, and

fells it for bullion, at fo many pence an ounce; the price of which bullion is, in the Englifh market, always above the price of filver at the mint, for the reafons now to be given.

When you fell ftandard-filver bullion at the mint, you are to be paid in weighty money; that is, you receive for your bullion the very fame weight in ftandard coin; the coinage coft nothing: but when you fell bullion in the market, you are paid in worn out filver, in gold, in bank-notes, in fhort, in every fpecies of lawful current money. Now all thefe payments have fome defect: the filver you are paid with is worn and light; the gold you are paid with is overrated, and perhaps alfo light; and the bank-notes muft have the fame value with the fpecie with which the bank pays them; that is, with light filver or overrated gold.

It is for thefe reafons, that filver bullion, which is bought by the mint at 5*s.* 2*d.* *per* ounce of heavy filver money, may be bought at market at 65 pence the ounce in light filver, over-rated gold, or bank-notes, which is the fame thing.

Further, we have feen how the impofition of coinage has the effect of raifing coin above the value of bullion, by adding a value to it which it had not as a metal.

Juft fo, when the unit is once affixed to certain determined quantities of both metals, if one of the metals fhould afterwards rife in value in the market, the coin made of that metal muft lofe a part of its value as coin, although it retains it as a metal. Confequently, as in the firft cafe it acquired an additional value by being coined, it muft now acquire an additional value by being melted down. From this we may conclude, that when the ftandard is affixed to both the metals in the coin, and when the proportion of that value is not made to follow the price of the market, that fpecies which rifes in the market is melted down, and the bullion is fold for a price as much exceeding the mint price as the metal has rifen in its value.

If, therefore, in England, the price of filver bullion is found to be at 65 pence the ounce, while at the mint it is rated at 62; this proves that filver has rifen $\frac{3}{65}$ above the proportion obferved in the coin, and that all coin of ftandard weight may confequently be melted down with a profit of $\frac{3}{65}$. But as there are feveral other circumftances to be attended to which regulate and influence the price of bullion, we fhall here pafs them in review, the better to difcover the nature of this diforder in the Englifh coin, and the advantages which money-jobbers may draw from it.

The price of bullion, like that of every other merchandife, is regulated by the value of the money it is paid with.

If bullion, therefore, fells in England for 65 pence an ounce, paid in filver coin, it muft fell for 65 fhillings the pound troy; that is to fay, the fhillings it is commonly paid with do not exceed the weight of $\frac{1}{65}$ of a pound troy: for if the 65 fhillings with which the pound of bullion is paid weighed more than a pound troy, it would be a fhorter and better way for him who wants bullion to melt down the fhillings and make ufe of the metal, than to go to market with them in order to get lefs.

We may, therefore, be very certain, that no man will buy filver bullion at 65 pence an ounce, with any fhilling which weighs above $\frac{1}{65}$ of a pound troy.

We have gone upon the fuppofition that the ordinary price of bullion in the Englifh market is 65 pence *per* ounce. This has been done upon the authority of fome late writers on this fubject: it is now proper to point out the caufes which may make it deviate from that value.

I. It may vary, and certainly will vary, in the price, according as the currency is better or worfe. When the expences of a war, or a wrong balance of trade, have carried off a great many heavy guineas, it is natural that bullion fhould rife; becaufe then it will be paid for more commonly in light gold and filver; that is to fay, with pounds Sterling, below the value of 113 grains fine gold, the worth of the pound Sterling in new guineas.

II. This wrong balance of trade, or a demand for bullion abroad, becoming very great, may occafion a fcarcity of the metals in the market, as well as a fcarcity of the coin; confequently, an advanced price muft be given for it in proportion to the greatnefs and height of the demand. In this cafe, both the fpecie and the bullion muft be bought with paper. But the rife in the price of bullion proceeds from the demand for the metals and the competition between merchants to procure them, and not becaufe the paper given as the price is at all of inferior value to the fpecie. The leaft difcredit of this kind would not tend to diminifh the value of the paper; it would annihilate it at once. Therefore, fince the metals muft be had, and that the paper cannot fupply the want of them when they are to be exported, the price rifes in proportion to the difficulties in finding metals elfewhere than in the Englifh market.

III. A fudden call for bullion, for the making of plate. A goldfmith can well afford to give 67 pence for an ounce of filver, that is to fay, he can afford to give one pound of gold for 14 pounds of filver, and perhaps for lefs, notwithftanding that what he gives be more than the ordinary proportion between the metals, becaufe he indemnifies himfelf amply by the price of his workmanfhip; juft as a tavern-keeper will pay any price for a fine fifh, becaufe, like the goldfmith, he buys for other people.

IV. The mint price has as great an effect in bringing down the price of bullion, as exchange has in raifing it. In countries where the metals in the coin are juftly proportioned, where all the currencies are of legal weight, and where coinage is impofed, the operations of trade make the price of bullion conftantly to fluctuate between the value of the coin and the mint-price of the metals.

Now let us fuppofe that the current price of filver bullion in the market is 65 pence the ounce, paid in lawful money, no matter of what weight or of what metal. Upon this the money-jobber falls to work. All fhillings which are above $\frac{1}{65}$ of a pound troy, he throws into his melting pot, and fells them as bullion for 65d. per ounce; all thofe which are below that weight he carries to market, and buys bullion with them at 65d. per ounce.

What is the confequence of this?

That thofe who fell the bullion, finding the fhillings which the money-jobber pays with perhaps not above $\frac{1}{66}$ of

Money.

$\frac{1}{66}$ of a pound troy, they on their fide raife the price of their bullion to 66d. the ounce.

This makes new work for the money-jobber; for he muft always gain. He now weighs all fhillings as they come to hand; and as formerly he threw into his melting-pot thofe only which were worth more than $\frac{1}{65}$ of a pound troy, he now throws in all that are in value above $\frac{1}{66}$. He then fells the melted fhillings at 66d. the ounce, and buys bullion with the light ones at the fame price.

This is the confequence of ever permitting any fpecies of coin to pafs by the authority of the ftamp, without controlling it at the fame time by the weight: and this is the manner in which money-jobbers gain by the currency of light money.

It is no argument againft this expofition of the matter to fay, that filver bullion is feldom bought with filver coin; becaufe the pence in new guineas are worth no more than the pence of fhillings of 65 in the pound troy: that is to fay, that 240 pence contained in $\frac{20}{21}$ of a new guinea, and 240 pence contained in 28 fhillings of 65 to the pound troy, differ no more in the intrinfic value than 0.83 of a grain of fine filver upon the whole, which is a mere trifle.

Whenever, therefore, fhillings come below the weight of $\frac{1}{65}$ of a pound troy, then there is an advantage in changing them for new guineas; and when that is the cafe, the new guineas will be melted down, and profit will be found in felling them for bullion, upon the principles we have juft been explaining.

We have already given a fpecimen of the domeftic operations of the money-jobbers; but thefe are not the moft prejudicial to national concerns. The jobbers may be fuppofed to be Englifhmen; and in that cafe the profit they make remains at home: but whenever there is a call for bullion to pay the balance of trade, it is evident that this will be paid in filver coin, never in gold, if heavy filver can be got; and this again carries away the filver coin, and renders it at home fo rare, that great inconveniences are found for want of the leffer denominations of it. The lofs, however, here is confined to an inconvenience; becaufe the balance of trade being a debt which muft be paid, we do not confider the exportation of the filver for that purpofe as any confequence of the diforder of the coin. But befides this exportation which is neceffary, there are others which are arbitrary, and which are made only with a view to profit of the wrong proportion.

When the money-jobbers find difficulty in carrying on the traffic we have defcribed, in the Englifh market, becaufe of the competition among themfelves, they carry the filver coin of the country, and fell it abroad for gold, upon the fame principles that the Eaft India company fend filver to China in order to purchafe gold.

It may be demanded, What hurt this trade can do to Britain, fince thofe who export filver bring back the fame value in gold? Were this trade carried on by natives, there would be no lofs; becaufe they would bring home gold for the whole intrinfic value of the filver. But if we fuppofe foreigners fending over gold to be coined at the Englifh mint, and changing the gold into Englifh filver coin, and then carrying off this coin, it is plain that they muft gain the difference, as well as the money-jobbers. But it may be anfwered, That having given gold for filver at the rate of the mint, they have given value for what they have received. Very right; but fo did Sir Hans Sloane, when he paid five guineas for an overgrown toad: he got value for his money; but it was value only to himfelf. Juft fo, whenever the Englifh government fhall be obliged to reftore the proportion of the metals (as they muft do), this operation will annihilate that imaginary value which they have hitherto fet upon gold; which imagination is the only thing which renders the exchange of their filver againft the foreign gold equal.

But it is farther objected, that foreigners cannot carry off the heavy filver; becaufe there is none to carry off. Very true; but then they have carried off a great quantity already: or if the Englifh Jews have been too fharp to allow fuch a profit to fall to ftrangers, (which may or may not have been the cafe), then this diforder is an effectual ftop to any more coinage of filver for circulation.

7. *Of the Diforder in the Britifh Coin, fo far as it affects the Value of the Pound Sterling Currency.*

From what has been faid, it is evident, that there muft be found in England two legal pounds Sterling, of different values; the one worth 113 grains of fine gold, the other worth 1718.7 grains of fine filver. We call them different; becaufe thefe two portions of the precious metals are of different values all over Europe.

But befides thefe two different pounds Sterling, which the change in the proportion of the metals have created, the other defects of the circulating coin produce fimilar effects. The guineas coined by all the princes fince King Charles II. have been of the fame ftandard weight and finenefs, $44\frac{1}{2}$ in a pound troy of ftandard gold $\frac{11}{12}$ fine: thefe have been conftantly wearing ever fince they have been coined; and in proportion to their wearing they are of lefs value.

If, therefore, the new guineas are below the value of a pound Sterling in filver, ftandard weight, the old muft be of lefs value ftill. Here then is another currency, that is, another pound Sterling; or indeed, more properly fpeaking, there are as many different pounds Sterling as there are guineas of different weights. This is not all; the money-jobbers having carried off all the weighty filver, that which is worn with ufe, and reduced even below the ftandard of gold, forms one currency more, and totally deftroys all determinate proportion between the money-unit and the currencies which are fuppofed to reprefent it.

It may be afked, how, at this rate, any filver has remained in England? It is anfwered, that the few weighty fhillings which ftill remain in circulation, have marvelloufly efcaped the hands of the money-jobbers: and as to the reft, the rubbing and wearing of thefe pieces has done what the ftate might have done; that is to fay, it has reduced them to their due proportion with the lighteft gold.

The diforder, therefore, of the Englifh coin has rendered the ftandard of a pound Sterling quite uncertain. To fay that it is 1718.7 grains of fine filver, is quite ideal. Who are paid in fuch pounds? To fay that it is 113 grains of pure gold, may alfo not be true; becaufe there are many currencies worfe than the new guineas.

What

What then is the consequence of all this disorder? What effect has it upon the current value of a pound Sterling? And which way can the value of that be determined?

The operations of trade bring value to an equation, notwithstanding the greatest irregularities possible; and so in fact a pound Sterling has acquired a determinate value over all the world by the means of foreign exchange. This is a kind of ideal scale for measuring the British coin, although it has not all the properties of that described above.

Exchange considers the pound Sterling as a value determined according to the combination of the values of all the different currencies, in proportion as payments are made in the one or the other; and as debtors generally take care to pay in the worst species they can, it consequently follows, that the value of the pound Sterling should fall to that of the lowest currency.

Were there a sufficient quantity of worn gold and silver to acquit all bills of exchange, the pound Sterling would come down to the value of them; but if the new gold be also necessary for that purpose, the value of it must be proportionally greater.

All these combinations are liquidated and compensated with one another, by the operations of trade and exchange: and the pound Sterling, which is so different in itself, becomes thereby, in the eyes of commerce, a determinate unit; subject, however, to variations, from which it never can be exempted.

Exchange, therefore, is one of the best measures for valuing a pound Sterling, present currency. Here occurs a question:

Does the great quantity of paper-money in England tend to diminish the value of the pound Sterling?

We answer in the negative. Paper money is just as good as gold or silver money, and no better. The variation of the standard, as we have already said, must influence the interests of debtors and creditors proportionally every where. From this it follows, that all augmention of the value of the money-unit in the specie must hurt the debtors in the paper money; and all diminutions, on the other hand, must hurt the creditors in the paper money as well as every where else. The payments, therefore, made in paper money, never can contribute to the regulation of the standard of the pound Sterling; it is the specie received in liquidation of that paper money which alone can contribute to mark the value of the British unit; because it is affixed to nothing else.

From this we may draw a principle, "That in countries where the money-unit is entirely affixed to the coin, the actual value of it is not according to the legal standard of that coin, but according to the mean proportion of the actual worth of those currencies in which debts are paid.

From this we see the reason why the exchange between England and all other trading towns in Europe has long appeared so unfavourable. People calculate the real par, upon the supposition that a pound Sterling is worth 1718.7 grains troy of fine silver, when in fact the currency is not perhaps worth 1638, the value of a new guinea in silver, at the market proportion of 1 to 14.5; that is to say, the currency is but 95.3 *per cent.* of the silver standard of the 43d of Elizabeth. No wonder then if the exchange be thought unfavourable.

From the principle we have just laid down, we may gather a confirmation of what we advanced concerning the cause of the advanced price of bullion in the English market.

When people buy bullion with current money at a determinate price, that operation, in conjunction with the course of exchange, ought naturally to mark the actual value of the pound Sterling with great exactness.

If therefore the price of standard bullion in the English market, when no demand is found for the exportation of the metals, that is to say, when paper is found for paper upon exchange, and when merchants versed in these matters judge exchange (that is, remittances) to be at par, if then silver bullion cannot be bought at a lower price than 65 pence the ounce, it is evident that this bullion might be bought with 65 pence in shillings, of which 65 might be coined out of the pound troy English standard silver; since 65 per ounce implies 65 shillings for the 12 ounces or pound troy.

This plainly shows how standard silver bullion should sell for 65 pence the ounce, in a country where the ounce of standard silver in the coin is worth no more than 62; and were the market-price of bullion to stand uniformly at 65 pence per ounce, that would show the value of the pound Sterling to be tolerably fixed. All the heavy silver coin is now carried off; because it was intrinsically worth more than the gold it passed for in currency. The silver therefore which remains is worn down to the market proportion of the metals, as has been said; that is to say, 20 shillings in silver currency are worth 113 grains of fine gold, at the proportion of 1 to 14.5 between gold and silver. Now,

as 1 is to 14.5, so is 113 to 1638:

so the 20 shillings current weigh but 1638 grains fine silver, instead of 1718.7, which they ought to do according to the standard.

Now let us speak of standard silver, since we are examining how far the English coin must be worn by use.

The pound troy contains 5760 grains. This, according to the standard, is coined into 62 shillings; consequently, every shilling ought to weigh 92.9 grains. Of such shillings it is impossible that ever standard bullion should sell at above 62 pence per ounce. If therefore such bullion sells for 65 pence, the shillings with which it is bought must weigh no more than 88.64 grains standard silver; that is, they must lose 4.29 grains, and are reduced to $\frac{1}{65}$ of a pound troy.

But it is not necessary that bullion be bought with shillings; no stipulation of price is ever made farther, than at so many pence Sterling per ounce. Does not this virtually determine the value of such currency with regard to all the currencies in Europe? Did a Spaniard, a Frenchman, or a Dutchman, know the exact quantity of silver bullion which can be bought in the London market for a pound Sterling, would he inform himself any farther as to the intrinsic value of that money-unit; would he not understand the value of it far better from that circumstance than by the

course

Money. course of any exchange, since exchange does not mark the intrinsic value of money, but only the value of that money transported from one place to another?

The price of bullion, therefore, when it is not influenced by extraordinary demand, (such as for the payment of a balance of trade, or for making an extraordinary provision of plate), but when it stands at what every body knows to be meant by the common market price, is a very tolerable measure of the value of the actual money-standard in any country.

If it be therefore true, that a pound Sterling cannot purchase above 1638 grains of fine silver bullion, it will require not a little logic to prove that it is really, or has been for these many years, worth any more; nothwithstanding that the standard weight of it in England is regulated by the laws of the kingdom at 1718.7 grains of fine silver.

If to this valuation of the pound Sterling drawn from the price of bullion, we add the other drawn from the course of exchange; and by this we find, that when paper is found for paper upon exchange, a pound Sterling cannot purchase above 1638 grains of fine silver in any country in Europe: upon these two authorities we may very safely conclude (as to the matter of fact at least) that the pound Sterling is not worth more, either in London or in any other trading city; and if this be the case, it is just worth 20 shillings of 65 to the pound troy.

If therefore the mint were to coin shillings at that rate, and pay for silver bullion at the market price, that is, at the rate of 65 pence per ounce in those new coined shillings, they would be in proportion to the gold; silver would be carried to the mint equally with gold, and would be as little subject to be exported or melted down.

It may be inquired in this place, how far the coining the pound troy into 65 shillings is contrary to the laws of England?

The moment a state pronounces a certain quantity of gold to be worth a certain quantity of silver, and orders these respective quantities of each metal to be received as equivalents of each other, and as lawful money in payments, that moment gold is made a standard as much as silver. If therefore too small a quantity of gold be ordered or permitted to be considered as an equivalent for the unit, the silver standard is from that moment debased; or indeed, more properly speaking, all silver money is from that moment proscribed; for who, from that time, will ever pay in silver, when he can pay cheaper in gold? Gold, therefore, by such a law, is made the standard, and all declarations to the contrary are against the matter of fact.

Were the king, therefore, to coin silver at 65 shillings in the pound, it is demonstration, that by such an act he would commit no adulteration upon the standard: the adulteration is already committed. The standard has descended to where it is by slow degrees, and by the operation of political causes only; and nothing prevents it from falling lower but the standard of the gold coin. Let guineas be now left to seek their value as they did formerly, and let light silver continue to go by tale, we shall see the guineas up at 30 shillings in 20 years time, as was the case in 1695.

It is as absurd to say that the standard of Queen Elizabeth has not been debased by enacting that the English unit shall be acquitted with 113 grains of fine gold, as it would be to affirm that it would not be debased from what it is at present by enacting that a pound of butter should every where be received in payment for a pound Sterling; although the pound Sterling should continue to consist of 3 ounces, 17 penny-weights, and 10 grains of standard silver, according to the statute of the 43d of Elizabeth. In that case, most debtors would pay in butter; and silver would, as at present, acquire a conventional value as a metal, but would be looked upon no longer as a standard, or as money.

If therefore, by the law of England, a pound Sterling must consist of 1718.7 grains troy of fine silver; by the law of England also, 113 grains of gold must be of the same value: but no law can establish that proportion; consequently, in which ever way a reformation be brought about, some law must be reversed; consequently, expediency, and not compliance with law, must be the motive in reforming the abuse

From what has been said, it is not at all surprising that the pound Sterling should in fact be reduced nearly to the value of the gold. Whether it ought to be kept at that value is another question. All that we here decide is, that coining the pound troy into 65 shillings would restore the proportion of the metals, and render both species common in circulation. But restoring the weight and proportion of the coin is not the difficulty which prevents a reformation of the English coinage.

8. *Circumstances to be attended to in a new Regulation of the British Coin.*

To people who do not understand the nature of such operations, it may have an air of justice to support the unit at what is commonly believed to be the standard of Queen Elizabeth, *viz.* at 1718.7 grains of fine silver.

The regulating the standard of both silver and gold to $\frac{11}{12}$ fine, and the pound Sterling to four ounces standard silver, as it stood during the reign of Queen Mary I. has also its advantages, as Mr Harris has observed. It makes the crown-piece to weigh just one ounce, the shilling four penny-weight, and the penny eight grains; consequently, were the new statute to bear, that the weight of the coin should regulate its currency upon certain occasions, the having the pieces adjusted to certain aliquot parts of weight would make weighing easy, and would accustom the common people to judge of the value of money by its weight, and not by the stamp.

In that case, there might be a conveniency in striking the gold coins of the same weight with the silver; because the proportion of their values would then constantly be the same with the proportion of the metals. The gold crowns would be worth at present, 3l. 12s. 6d. the half crowns 1l. 16s. 3d. the gold shillings 14s. and 6d. and the half 7s. and 3d. This was anciently the practice in the Spanish mints.

The interests within the state can be nowise perfectly protected but by permitting conversions of value from the old to the new standard, whatever it be, and by

by regulating the footing of ſuch converſations by act of parliament, according to circumſtances.

For this purpoſe, we ſhall examine thoſe intereſts which will chiefly merit the attention of government, when they form a regulation for the future of acquitting permanent contracts already entered into. Such as may be contracted afterwards will naturally follow the new ſtandard.

The landed intereſt is no doubt the moſt conſiderable in the nation. Let us therefore examine, in the firſt place, what regulations it may be proper to make, in order to do juſtice to this great claſs, with reſpect to the land-tax on one hand, and with reſpect to their leſſees on the other.

The valuation of the lands of England was made many years ago, and reaſonably ought to be ſupported at the real value of the pound Sterling at that time, according to the principles already laid down. The general valuation, therefore, of the whole kingdom will riſe according to this ſcheme. This will be conſidered as an injuſtice; and no doubt it would be ſo, if, for the future, the land-tax be impoſed as heretofore, without attending to this circumſtance; but as that impoſition is annual, as it is laid on by the landed intereſt itſelf, who compoſe the parliament, it is to be ſuppoſed that this great claſs will at leaſt take care of their own intereſt.

Were the valuation of the lands to be ſtated according to the valuation of the pound Sterling of 1718.7 grains of ſilver, which is commonly ſuppoſed to be the ſtandard of Elizabeth, there would be no great injury done: this would raiſe the valuation only 5 per cent. and the land-tax in proportion.

There is no claſs of inhabitants in all England ſo much at their eaſe, and ſo free from taxes, as the claſs of farmers. By living in the country, and by conſuming the fruits of the earth without their ſuffering any alienation, they avoid the effect of many exciſes, which, by thoſe who live in corporations, are felt upon many articles of their conſumption, as well as on thoſe which are immediately loaded with theſe impoſitions. For this reaſon it will not, perhaps, appear unreaſonable, if the additional 5 *per cent.* on the land-tax were thrown upon this claſs, and not upon the landlords.

With reſpect to leaſes, it may be obſerved, that we have gone upon the ſuppoſition that the pound Sterling in the year 1728 was worth 1718,7 grains of fine ſilver, and 113 grains of fine gold.

There would be no injuſtice done the leſſees of all the lands in the kingdom, were their rents to be fixed at the mean proportion of theſe values. We have obſerved how the pound Sterling has been gradually diminiſhing in its worth from that time by the gradual riſe of the ſilver. This mean proportion, therefore, will nearly anſwer to what the value of the pound Sterling was in 1743; ſuppoſing the riſe of the ſilver to have been uniform.

It may be farther alleged in favour of the landlords, that the gradual debaſement of the ſtandard has been more prejudicial to their intereſt in letting their lands, than to the farmers in diſpoſing of the fruits of them. Proprietors cannot ſo eaſily raiſe their rents upon new leaſes, as farmers can raiſe the prices of their grain according to the debaſement of the value of the currency.

The pound Sterling, thus regulated at the mean proportion of its worth, as it ſtands at preſent, and as it ſtood in 1728, may be realiſed in 1678.6 grains of fine ſilver, and 115.76 grains fine gold; which is 2.4 *per cent.* above the value of the preſent currency. No injury, therefore, would be done to leſſees, and no unreaſonable gain would accrue to the landed intereſt, in appointing converſions of all land-rents at $2\frac{1}{2}$ *per cent.* above the value of the preſent currency.

Without a thorough knowledge of every circumſtance relating to Great Britain, it is impoſſible to lay down any plan. It is ſufficient here briefly to point out the principles upon which it muſt be regulated.

The next intereſt to be conſidered is that of the nation's creditors. The right regulation of their concerns will have a conſiderable influence in eſtabliſhing public credit upon a ſolid baſis, by making it appear to all the world, that no political operation upon the money of Great Britain can in any reſpect either benefit or prejudice the intereſt of thoſe who lend their money upon the faith of the nation. The regulating alſo the intereſt of ſo great a body, will ſerve as a rule for all creditors who are in the ſame circumſtances, and will upon other accounts be productive of greater advantages to the nation in time coming.

In 1749, a new regulation was made with the public creditors, when the intereſt of the whole redeemable national debt was reduced to 3 *per cent.* This circumſtance infinitely facilitates the matter with reſpect to this claſs, ſince, by this innovation of all former contracts, the whole national debt may be conſidered as contracted at, or poſterior to, the 25th of December 1749.

Were the ſtate, by any arbitrary operation upon money (which every reformation muſt be), to diminiſh the value of the pound Sterling in which the parliament at that time bound the nation to acquit thoſe capitals and the intereſt upon them, would not all Europe ſay, That the Britiſh parliament had defrauded their creditors? If therefore the operation propoſed to be performed ſhould have a contrary tendency, *viz.* to augmment the value of the pound Sterling with which the parliament at that time bound the nation to acquit thoſe capitals and intereſts, muſt not all Europe alſo agree, That the Britiſh parliament had defrauded the nation?

This convention with the ancient creditors of the ſtate, who, in conſequence of the debaſement of the ſtandard, might have juſtly claimed an indemnification for the loſs upon their capitals, lent at a time when the pound Sterling was at the value of the heavy ſilver, removes all cauſes of complaint from that quarter. There was in the year 1749 an innovation in all their contracts; and they are now to be conſidered as creditors only from the 25th of December of that year.

Let the value of the pound Sterling be inquired into during one year preceding and one poſterior to the tranſaction of the month of December 1749. The great ſums borrowed and paid back by the nation during that period, will furniſh data ſufficient for that calculation. Let this value of the pound be ſpecified in

Money. in troy grains of fine ſilver and fine gold bullion, without mentioning any denomination of money according to the exact proportion of the metals at that time. And let this pound be called the *pound of national credit*.

This firſt operation being determined, let it be enacted, that the pound Sterling, by which the ſtate is to borrow for the future, and that in which the creditors are to be paid, ſhall be the exact mean proportion between the quantities of gold and ſilver above ſpecified, according to the actual proportion of the metals at the time ſuch payments ſhall be made: or that the ſums ſhall be borrowed or acquitted, one half in gold and one half in ſilver, at the reſpective requiſitions of the creditors or of the ſtate, when borrowing. All debts contracted poſterior to 1749 may be made liable to converſions.

The conſequence of this regulation will be the inſenſible eſtabliſhment of a bank-money. Nothing would be more difficult to eſtabliſh, by a poſitive revolution, than ſuch an invariable meaſure; and nothing will be found ſo eaſy as to let it eſtabliſh itſelf by its own advantages. This bank-money will be liable to much fewer inconveniences than that of Amſterdam. There the perſons tranſacting muſt be upon the ſpot; here, the Sterling currency may, every quarter of a year, be adjuſted by the exchequer to this invariable ſtandard, for the benefit of all debtors and creditors who incline to profit of the ſtability of this meaſure of value.

This ſcheme is liable to no inconvenience from the variation of the metals, let them be ever ſo frequent or hard to be determined; becauſe upon every occaſion where there is the ſmalleſt doubt as to the actual proportion, the option competent to creditors to be paid half in ſilver and half in gold will remove.

Such a regulation will alſo have this good effect, that it will give the nation more juſt ideas of the nature of money, and conſequently of the influence it ought to have upon prices.

If the value of the pound Sterling ſhall be found to have been by accident leſs in December 1749 than it is at preſent; or if at preſent the currency be found below what has commonly been ſince 1749; in juſtice to the creditors, and to prevent all complaints, the nation may grant them the mean proportion of the value of the pound Sterling from 1749 to 1760, or any other which may to parliament appear reaſonable.

This regulation muſt appear equitable in the eyes of all Europe; and the ſtrongeſt proof of it will be, that it will not produce the ſmalleſt effect prejudicial to the intereſt of the foreign creditors. The courſe of exchange with regard to them will ſtand preciſely as before.

A Dutch, French, or German creditor, will receive the ſame value for his intereſt in the Engliſh ſtocks as heretofore. This muſt ſilence all clamours at home, being the moſt convincing proof, that the new regulation of the coin will have made no alteration upon the real value of any man's property, let him be debtor or creditor.

The intereſt of every other denomination of creditors, whoſe contracts are of a freſh date, may be regulated upon the ſame principles. But where debts are of an old ſtanding, juſtice demands, that attention be had to the value of money at the time of contracting. Nothing but the ſtability of the Engliſh coin, when compared with that of other nations, can make ſuch a propoſal appear extraordinary. Nothing is better known in France than this ſtipulation added to obligations, *Argent au cours de ce jour*; that is to ſay, That the ſum ſhall be repaid in coin of the ſame intrinſic value with what has been lent. Why ſhould ſuch a clauſe be thought reaſonable for guarding people againſt arbitrary operations upon the numerary value of the coin, and not be found juſt upon every occaſion where the numerary value of it is found to be changed, let the cauſe be what it will?

The next intereſt we ſhall examine is that of trade. When men have attained the age of 21, they have no more occaſion for guardians. This may be applied to traders; they can parry with their pen every inconvenience which may reſult to other people from the changes upon money, provided only the laws permit them to do themſelves juſtice with reſpect to their engagements. This claſs demands no more than a right to convert all reciprocal obligations into denominations of coin of the ſame intrinſic value with thoſe they have contracted in.

The next intereſt is that of buyers and ſellers; that is, of manufacturers with regard to conſumers, and of ſervants with reſpect to thoſe who hire their perſonal ſervice.

The intereſt of this claſs requires a moſt particular attention. They muſt, literally ſpeaking, be put to ſchool, and taught the firſt principles of their trade, which is buying and ſelling. They muſt learn to judge of price by the grains of ſilver and gold they receive: they are children of a mercantile mother, however warlike the father's diſpoſition. If it be the intereſt of the ſtate that their bodies be rendered robuſt and active, it is no leſs the intereſt of the ſtate that their minds be inſtructed in the firſt principles of the trade they exerciſe.

For this purpoſe, tables of converſion from the old ſtandard to the new muſt be made, and ordered to be put up in every market, in every ſhop. All duties, all exciſes, muſt be converted in the ſame manner. Uniformity muſt be made to appear every where. The ſmalleſt deviation from this will be a ſtumbling-block to the multitude.

Not only the intereſt of the individuals of the claſs we are at preſent conſidering, demands the nation's care and attention in this particular; but the proſperity of trade, and the well-being of the nation, are alſo deeply intereſted in the execution.

The whole delicacy of the intricate combinations of commerce depends upon a juſt and equable vibration of prices, according as circumſtances demand it. The more, therefore, the induſtrious claſſes are inſtructed in the principles which influence prices, the more eaſily will the machine move. A workman then learns to ſink his price without regret, and can raiſe it without avidity. When principles are not underſtood, prices cannot gently fall, they muſt be pulled down; and merchants dare not ſuffer them to riſe, for fear of abuſe, even

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even although the perfection of an infant manufacture ſhould require it.

The laſt intereſt is that of the bank of England, which naturally muſt regulate that of every other.

Had this great company followed the example of other banks, and eſtabliſhed a bank-money of an invariable ſtandard as the meaſure of all their debts and credits, they would not have been liable to any inconvenience upon a variation of the ſtandard.

The bank of England was projected about the year 1694, at a time when the current money of the nation was in the greateſt diſorder, and government in the greateſt diſtreſs both for money and for credit. Commerce was then at a very low ebb; and the only, or at leaſt the moſt profitable, trade of any, was jobbing in coin, and carrying backwards and forwards the precious metals from Holland to England. Merchants profited alſo greatly from the effects which the utter diſorder of the coin produced upon the price of merchandiſe.

At ſuch a juncture the reſolution was taken to make a new coinage; and upon the proſpect of this, a company was found, who, for an excluſive charter to hold a bank for 13 years, willingly lent the government upwards of a million Sterling at 8 *per cent.* (in light money we ſuppoſe), with a proſpect of being repaid both intereſt and capital in heavy. This was not all: part of the money lent was to be applied for the eſtabliſhment of the bank; and no leſs than 4000l. a-year was allowed to the company, above the full intereſt, for defraying the charge of the management.

Under ſuch circumſtances the introduction of bank-money was very ſuperfluous, and would have been very impolitic. That invention is calculated againſt the raiſing of the ſtandard: but here the bank profited of that riſe in its quality of creditor for money lent; and took care not to commence debtor by circulating their paper until the effect of the new regulation took place in 1695; that is, after the general re-coinage of all the clipped ſilver.

From that time till now, the bank of England has been the baſis of the nation's credit, and with great reaſon has been conſtantly under the moſt intimate protection of every miniſter.

The value of the pound Sterling, as we have ſeen, has been declining ever ſince the year 1601, the ſtandard being fixed to ſilver during all that century, while the gold was conſtantly riſing. No ſooner had the proportion taken another turn, and ſilver begun to riſe, than the government of England threw the ſtandard virtually upon the gold, by regulating the value of the guineas at the exact proportion of the market. By theſe operations, however, the bank has conſtantly been a gainer (in its quality of debtor) upon all the paper in circulation; and therefore has loſt nothing by not having eſtabliſhed a bank-money.

The intereſt of this great company being eſtabliſhed upon the principles we have endeavoured to explain, it is very evident, that the government of England never will take any ſtep in the reformation of the coin which in its conſequences can prove hurtful to the bank. Such a ſtep would be contrary both to juſtice and to common ſenſe. To make a regulation which, by raiſing the ſtandard, will prove beneficial to the public creditors, to the prejudice of the bank (which we may call the *public debtor*), would be an operation upon public credit like that of a perſon who is at great pains to ſupport his houſe by props upon all ſides, and who at the ſame time blows up the foundation of it with gunpowder.

We may therefore conclude, that with regard to the bank of England, as well as every other private banker, the notes which are conſtantly payable upon demand muſt be made liable to a converſion at the actual value of the pound Sterling at the time of the new regulation.

That the bank will gain by this, is very certain; but the circulation of their notes is ſo ſwift, that it would be abſurd to allow to the then poſſeſſors of them that indemnification which naturally ſhould be ſhared by all thoſe through whoſe hands they have paſſed, in proportion to the debaſement of the ſtandard during the time of their reſpective poſſeſſion.

Beſides theſe conſiderations, which are in common to all ſtates, the government of Great Britain has one peculiar to itſelf. The intereſt of the bank, and that of the creditors, are diametrically oppoſite: every thing which raiſes the ſtandard hurts the bank; every thing which can ſink it hurts the creditors: and upon the right management of the one and the other, depends the ſolidity of public credit. For theſe reaſons, without the moſt certain proſpect of conducting a reſtitution of the ſtandard to the general advantage as well as approbation of the nation, no miniſter will probably ever undertake ſo dangerous an operation.

We ſhall now propoſe an expedient which may remove at leaſt ſome of the inconveniences which would reſult from ſo extenſive an undertaking as that of regulating the reſpective intereſts in Great Britain by a poſitive law, upon a change in the value of their money of account.

Suppoſe then, that, before any change is made in the coin, government ſhould enter into a tranſaction with the public creditors, and aſcertain a permanent value for the pound ſterling for the future, ſpecified in a determined proportion of the fine metals in common bullion, without any regard to money of account, or to any coin whatever.

This preliminary ſtep being taken, let the intended alteration of the ſtandard be proclaimed a certain time before it is to commence. Let the nature of the change be clearly explained, and let all ſuch as are engaged in contracts which are diſſolvable at will upon the preſtations ſtipulated, be acquitted between the parties, or innovated as they ſhall think proper; with certification, that, poſterior to a certain day, the ſtipulations formerly entered into ſhall be binding according to the denominations of the money of account in the new ſtandard.

As to permanent contracts, which cannot at once be fulfilled and diſſolved, ſuch as leaſes, the parliament may either preſcribe the methods and terms of converſion; or a liberty may be given to the parties to annul the contract, upon the debtor's refuſing to perform his agreement according to the new ſtandard. Contracts, on the other hand, might remain ſtable, with reſpect to creditors who would be ſatisfied with payments made on the footing of the old ſtandard. If the riſe intended ſhould not be very conſiderable, no great injuſtice can follow ſuch a regulation.

Money.

Annuities are now thoroughly underſtood, and the value of them is brought to ſo nice a calculation, that nothing will be eaſier than to regulate theſe upon the footing of the value paid for them, or of the ſubject affected by them. If by the regulation, land-rents are made to riſe in denomination, the annuities charged upon them ought to riſe in proportion; if in intrinſic value, the annuity ſhould remain as it was.

9. *Regulations which the Principles of this Inquiry point out as expedient to be made by a new Statute for regulating the Britiſh Coin.*

Let us now examine what regulations it may be proper to make by a new ſtatute concerning the coin of Great Britain, in order to preſerve always the ſame exact value of the pound Sterling realized in gold and in ſilver, in ſpite of all the incapacities inherent in the metals to perform the functions of an invariable ſcale or meaſure of value.

1. The firſt point is to determine the exact number of grains of fine gold and fine ſilver which are to compoſe it, according to the then proportion of the metals in the London market.

2. To determine the proportion of theſe metals with the pound troy; and in regard that the ſtandard of gold and ſilver is different, let the mint price of both metals be regulated according to the pound troy fine.

3. To fix the mint price within certain limits; that is to ſay, to leave to the king and council, by proclamation, to carry the mint price of bullion up to the value of the coin, as is the preſent regulation, or to ſink it to   *per cent.* below that price, according as government ſhall incline to impoſe a duty upon coinage.

4. To order, that ſilver and gold coin ſhall be ſtruck of ſuch denominations as the king ſhall think fit to appoint; in which the proportion of the metals above determined ſhall be conſtantly obſerved through every denomination of the coin, until neceſſity ſhall make a new general coinage unavoidable.

5. To have the number of grains of the fine metal in every piece marked upon the exergue, or upon the legend of the coin, in place of ſome initial letters of titles, which not one perſon in a thouſand can decypher; and to make the coin of as compact a form as poſſible, diminiſhing the ſurface of it as much as is conſiſtent with beauty.

6. That it ſhall be lawful for all contracting parties to ſtipulate their payments either in gold or ſilver coin, or to leave the option of the ſpecies to one of the parties.

7. That where no particular ſtipulation is made, creditors ſhall have power to demand payment, half in one ſpecies, half in the other; and when the ſum cannot fall equally into gold and ſilver coins, the fractions to be paid in ſilver.

8. That in buying and ſelling, when no particular ſpecies has been ſtipulated, and when no act in writing has intervened, the option of the ſpecies ſhall be competent to the buyer.

9. That all ſums paid or received by the king's receivers, or by bankers, ſhall be delivered by weight, if demanded.

10. That all money which ſhall be found under the legal weight, from whatever cauſe it may proceed, may be rejected in every payment whatſoever; or if offered in payment of a debt above a certain ſum, may be taken according to its weight, at the then mint price, in the option of the creditor.

11. That no penalty ſhall be incurred by thoſe who melt down or export the nation's coin; but that waſhing, clipping, or diminiſhing the weight of any part of it ſhall be deemed felony, as much as any other theft, if the perſon ſo degrading the coin ſhall afterwards make it circulate for lawful money.

To prevent the inconveniences proceeding from the variation in the proportion between the metals, it may be provided,

12. That upon every variation of proportion in the market-price of the metals, the price of both ſhall be changed, according to the following rule:

Let the price of the pound troy fine gold in the coin be called *G*.

Let the price of ditto in the ſilver be called *S*.

Let the new proportion between the market-price of the metals be called *P*.

Then ſtate this formula:

$\frac{G}{2P} + \frac{S}{2} =$ to a pound troy fine ſilver, in Sterling currency.

$\frac{S}{2} + P + \frac{G}{2} =$ to a pound troy fine gold, in Sterl. currency.

This will be a rule for the mint to keep the price of the metals conſtantly at par with the price of the market; and coinage may be impoſed, as has been deſcribed, by fixing the mint price of them at a certain rate below the value of the fine metals in the coin.

13. As long as the variation of the market-price of the metals ſhall not carry the price of the riſing metal ſo high as the advanced price of the coin above the bullion, no alteration need be made on the denomination of either ſpecies.

14. So ſoon as the variation of the market price of the metals ſhall give a value to the riſing ſpecies, above the difference between the coin and the bullion; then the king ſhall alter the denominations of all the coin, ſilver and gold, adding to the coins of the riſing metal exactly what is taken from thoſe of the other. An example will make this plain:

Let us ſuppoſe that the coinage has been made according to the proportion of 14.5 to 1; that 20 ſhillings, or 4 crown-pieces, ſhall contain, in fine ſilver, 14.5 times as many grains as the guinea, or the gold pound, ſhall contain grains of fine gold. Let the new proportion of the metals be ſuppoſed to be 14 to 1. In that caſe, the 20 ſhillings, or the 4 crowns, will contain $\frac{1}{28}$ more value than the guinea. Now ſince there is no queſtion of making a new general coinage upon every variation, in order to adjuſt the proportion of the metals in the weight of the coins, that proportion might be adjuſted by changing their reſpective denominations according to this formula:

Let the 20 ſhillings, or 4 crowns, in coin, be called *S*. Let the guinea be called *G*. Let the difference between the old proportion and the new, which is $\frac{1}{28}$, be called *P*. Then ſay,

$S - \frac{P}{2} =$ a pound ſterling, and $G + \frac{P}{2} =$ a pound ſterl.

By this it appears that all the ſilver coin muſt be raiſed

 raised in its denomination $\frac{1}{18}$, and all the gold coin must be lowered in its denomination $\frac{1}{18}$; yet still S + G will be equal to two pounds Sterling, as before, whether they be considered according to the old or according to the new denominations.

But it may be observed, that the imposition of coinage rendering the value of the coin greater than the value of the bullion, that circumstance gives a certain latitude in fixing the new denominations of the coin, so as to avoid minute fractions. For, providing the deviation from the exact proportion shall fall within the advanced price of the coin, no advantage can be taken by melting down one species preferably to another; since, in either case, the loss incurred by melting the coin must be greater than the profit made upon selling the bullion. The mint price of the metals, however, may be fixed exactly, that is, within the value of a farthing upon a pound of fine silver or gold. This is easily reckoned at the mint; although upon every piece in common circulation the fractions of farthings would be inconvenient.

15. That notwithstanding of the temporary variations made upon the denomination of the gold and silver coins, all contracts formerly entered into, and all stipulations in pounds shillings and pence, may continue to be acquitted according to the old denominations of the coins, paying one-half in gold and one-half in silver: unless in the case where a particular species has been stipulated; in which case, the sums must be paid according to the new regulation made upon the denomination of that species, to the end that neither profit or loss may result to any of the parties.

16. That notwithstanding the alterations on the mint price of the metals, and in the denomination of the coins, no change shall be made upon the weight of the particular pieces of the latter, except in the case of a general re-coinage of one denomination at least: that is to say, the mint must not coin new guineas, crowns, &c. of a different weight from those already in currency, although by so doing the fractions might be avoided. This would occasion confusion, and the remedy would cease to be of any use upon a new change in the proportion of the metals. But it may be found convenient, for removing the small fractions in shillings and sixpences, to recoin such denominations altogether, and to put them to their integer numbers, of twelve and of six pence, without changing in any respect their proportion of value to all other denominations of the coin: this will be no great expence, when the bulk of the silver coin is put into 5 shilling pieces.

By this method of changing the denominations of the coin, there never can result any alteration in the value of the pound Sterling; and although fractions of value may now and then be introduced, in order to prevent the abuses to which the coin would otherwise be exposed by the artifice of those who melt it down, yet still the inconvenience of such fractions may be avoided in paying, according to the old denominations, in both species, by equal parts. This will also prove demonstratively, that no change is thereby made in the true value of the national unit of money.

17. That it be ordered, that shillings and sixpences shall only be current for 20 years; and all other coins, both gold and silver, for 40 years, or more. For ascertaining which term, there may be marked, upon the exergue of the coin, the last year of their currency, in place of the date of their fabrication. This term elapsed, or the date effaced, that they shall have no more currency whatsoever; and, when offered in payment, may be received as bullion at the actual price of the mint, or refused, at the option of the creditor.

18. That no foreign coin shall have any *legal* currency, except as bullion at the mint price.

By these and the like regulations may be prevented, 1*mo*, The melting or exporting of the coin in general. 2*do*, The melting or exporting one species, in order to sell it as bullion at an advanced price. 3*tio*, The profit in acquitting obligations preferably in one species to another. 4*to*, The degradation of the standard, by the wearing of the coin, or by a change in the proportion between the metals. 5*to*, The circulation of the coin below the legal weight. 6*to*, The profit that other nations reap by paying their debts more cheaply to Great Britain than Great Britain can pay her's to them.

And the great advantage of it is, that it is an uniform plan, and may serve as a perpetual regulation, compatible with all kinds of denominations of coins, variations in the proportion of the metals, and with the imposition of a duty upon coinage, or with the preserving it free; and further, that it may in time be adopted by other nations, who will find the advantage of having their money of account preserved perpetually at the same value, with respect to the denominations of all foreign money of account established on the same principles.

A TABLE

A TABLE OF COINS,

Showing the Quantity of Fine Metal contained in them.

The number of grains of fine metal in every coin is ſought for in the regulations of the mint of the country where it is coined, and is expreſſed in the grains in uſe in that mint. From that weight it is converted into thoſe of other countries according to the following proportions:

3840 Troy grains, 4676.35 Paris grains, 5192.8 Holland aces or grains, and 4649.06 Colonia grains, are ſuppoſed to be equal weights; and the coins in the Table are converted according to thoſe proportions.

	Table of Coins, reduced to Grains of fine Metal, according to the Troy, Paris, Colonia, and Holland weights.	Gold Coins.				Silver Coins.			
		Troy.	Paris.	Colonia.	Holland.	Troy.	Paris.	Colonia.	Holland.
English Coins.	1 A Guinea by ſtatute — — — —	118.651	144.46	143.65	160.45				
	2 A Crown by ſtatute — — —	— —	— —	— —	— —	429.68	523.2	520.2	581.
	3 A Shilling by ſtatute — — —	— —	— —	— —	— —	85.935	104.65	104.	116.2
	4 A Silver Pound Sterling by ſtatute 1601 — —	— —	— —	— —	— —	1718.7	2093.	2080.8	2324.1
	5 A Gold Pound Sterling by ſtatute 1728 — —	113.	137.61	136.8	152.8				
	6 A Silver Pound Sterling in currency $=\frac{20}{63}$ lb. Troy —	— —	— —	— —	— —	1639.38	1996.4	1984.7	2216.
	7 A Silver pound Sterl. at the proportion of gold to ſilver as 1 to $14\frac{1}{2}$	113.	137.61	136.8	152.8	1638.5	1995.3	1983.7	2215.7
	8 A Gold Pound Sterling at the ſame proportion of 1 to $14\frac{1}{2}$	118.4	144.18	143.34	160.11	1718.7	2093.	2080.8	2324.1
	9 A Pound Sterling at the mean proportion in gold and in ſilver	115.769	140.98	140.16	156.55	1678.6	2044.2	2032.2	2269.9
	10 A Shilling current $=\frac{1}{63}$ of a pound Troy — —	— —	— —	— —	— —	81.961	99.8	99.	110.82
	11 A Guinea in Silver, or 21 Shillings ſtandard weight —	— —	— —	— —	— —	1804.6	2197.6	2184.8	2440.3
	12 A Guinea at the proportion of 1 to $14\frac{1}{2}$, worth in Silver	— —	— —	— —	— —	1720.4	2095.1	2082.8	2326.4
	13 A Pound Troy, or 12 ounces Engliſh weight — —	5760.	7019.2	6973.5	7789.2				
French Coins.	1 A Louis d'or — — —	113.27	137.94	137.13	153.17				
	2 A Crown of ſix livres — — —	— —	— —	— —	— —	409.94	499.22	496.3	554.3
	3 A Crown of three ditto — — —	— —	— —	— —	— —	204.97	249.61	248.15	277.1
	4 A livre — — — —	— —	— —	— —	— —	68.34	83.23	82.74	92.42
	5 A Louis d'or, or 24 livres in ſilver — —	— —	— —	— —	— —	1639.7	1996.9	1985.2	2217.4
	6 A Marc of Paris weight, fine gold or ſilver — —	3783.87	4608.	4581.1	5116.9	3783.87	4608.	4581.1	5116.9
	7 A Marc of gold coin effective weight, in fine —	3398.3	4138.5	4114.3	4593.4				
	8 A Mark of ſilver coin effective weight, in fine —	— —	— —	— —	— —	3402.3	4143.4	4119.2	4600.9
German Coins.	1 A Carolin legal weight — —	115.45	140.6	139.78	156.12				
	2 A Ducat of the Empire ditto — —	52.8	64.37	64.	71.48				
	3 A Florin of Convention — — —	— —	— —	— —	— —	179.73	218.87	217.6	243.
	4 A Dollar of Convention — —	— —	— —	— —	— —	269.59	328.31	326.4	364.5
	5 A Dollar of Exchange, the Carolin = 9 flor. 42 kreutzers	17.85	21.74	21.615	24.14				
	6 A Florin current $=\frac{1}{11}$ of a Carolin —	10.54	12.84	12.77	14.26				
	7 A Carolin in ſilver, at the proportion of 1 to $14\frac{1}{2}$ —	— —	— —	— —	— —	1674.	2038.6	2026.8	2263.8
Dutch Coins.	1 A Dutch Ducat — — —	51.76	6.3	62.67	70.				
	2 A Florin in Silver — — —	— —	— —	— —	— —	148.	180.3	179.2	200.21

UNIVER-

UNIVERSAL TABLE

Of the present State of the REAL and IMAGINARY MONIES of the World.

† This mark is prefixed to the Imaginary Money, or Money of Account.

All Fractions in the Value English are Parts of a PENNY.

= This mark signifies *is*, *make*, or *equal to*.

ENGLAND AND SCOTLAND.

London, Bristol, Liverpool, &c.
Edinburgh, Glasgow, Aberdeen, &c.

			£.	s.	d.
A Farthing		- - -	0	0	$0\frac{1}{4}$
2 Farthings	=	a Halfpenny -	0	0	$0\frac{1}{2}$
2 Halfpence		a Penny -	0	0	1
4 Pence		a Groat -	0	0	4
6 Pence		a Half Shilling	0	0	6
12 Pence		a Shilling -	0	1	0
5 Shillings		a Crown - -	0	5	0
20 Shillings		†a Pound Sterling	1	0	0
21 Shillings		a Guinea -	1	1	0

IRELAND.

Dublin, Cork, Londonderry, &c.

			£.	s.	d.
A Farthing		- -	0	0	$0\frac{3}{13}$
2 Farthings	=	a Halfpenny -	0	0	$0\frac{6}{13}$
2 Halfpence		†a Penny - -	0	0	$0\frac{12}{13}$
$6\frac{1}{2}$ Pence		a Half Shilling -	0	0	6
12 Pence		†a Shilling Irish -	0	0	$11\frac{3}{13}$
13 Pence		a Shilling -	0	1	0
65 Pence		a Crown - -	0	5	0
20 Shillings		†a Pound Irish	0	18	$5\frac{1}{2}$
$22\frac{3}{4}$ Shillings		a Guinea -	1	1	0

FLANDERS AND BRABANT.

Ghent, Ostend, &c. Antwerp, Brussels, &c.

			£.	s.	d.
†A Pening		- - -	0	0	$0\frac{9}{160}$
4 Peningens	=	an Urche - -	0	0	$0\frac{9}{40}$
8 Peningens		†a Grote -	0	0	$0\frac{9}{20}$
2 Grotes		a Petard - -	0	0	$0\frac{9}{10}$
6 Petards		†a Scalin -	0	0	$5\frac{2}{5}$
7 Petards		a Scalin -	0	0	$6\frac{3}{10}$
40 Grotes		†a Florin -	0	1	6
$17\frac{1}{2}$ Scalins		a Ducat -	0	9	3
240 Grotes		†a Pound Flem. -	0	9	0

HOLLAND AND ZEALAND.

Amsterdam, Rotterdam, Middleburg, Flushing, &c.

			£.	s.	d.
†Pening		- - -	0	0	$0\frac{21}{320}$
8 Peningens	=	†a Grote - -	0	0	$0\frac{21}{40}$
2 Grotes		a Stiver -	0	0	$1\frac{1}{20}$
6 Stivers		a Scalin -	0	0	$6\frac{3}{10}$
20 Stivers		a Guilder -	0	1	9
50 Stivers		a Rix-dollar -	0	4	$4\frac{1}{4}$

EUROPE, Northern Parts.

HOLLAND, &c.

		£.	s.	d.
60 Stivers	a Dry Guilder -	0	5	3
105 Stivers	a Ducat - -	0	9	3
6 Guilders	†a Pound Flem. -	0	10	6

GERMANY.

HAMBURG. *Altena, Lubec, Bremen, &c.*

			£.	s.	d.
†A Tryling	=	- - -	0	0	$0\frac{3}{128}$
2 Trylings		†a Sexling -	0	0	$0\frac{3}{64}$
2 Sexlings		a Fening -	0	0	$0\frac{3}{32}$
12 Fenings		a Shilling Lub.	0	0	$1\frac{1}{8}$
16 Shillings		†a Marc -	0	1	6
2 Marcs		a Slet dollar -	0	3	0
3 Marcs		a Rix-dollar -	0	4	6
$6\frac{1}{4}$ Marcs		a Ducat -	0	9	$4\frac{1}{2}$
120 Shillings		†a Pound Flem.	0	11	3

HANOVER. *Lunenburgh, Zell, &c.*

			£.	s.	d.
†A Fening	=	- -	0	0	$0\frac{7}{48}$
3 Fenings		a Dreyer -	0	0	$0\frac{7}{16}$
8 Fenings		a Marien - -	0	0	$1\frac{1}{3}$
12 Fenings		a Grosh -	0	0	$0\frac{3}{4}$
8 Groshen		a Half Gulden -	0	1	2
16 Groshen		a Gulden -	0	2	4
24 Groshen		†a Rix-dollar -	0	3	6
32 Groshen		a Double Gulden	0	4	8
4 Guldens		a Ducat -	0	9	2

SAXONY AND HOLSTEIN.

Dresden, Leipsic, &c. Wismar, Keil, &c.

			£.	s.	d.
†An Heller	=	- -	0	0	$0\frac{7}{96}$
2 Hellers		a Fening -	0	0	$0\frac{7}{48}$
6 Hellers		a Dreyer -	0	0	$0\frac{7}{16}$
16 Hellers		a Marien - -	0	0	$1\frac{1}{6}$
12 Fenings		a Grosh -	0	0	$1\frac{3}{4}$
16 Groshen		a Gould - -	0	2	4
24 Groshen		†a Rix-dollar -	0	3	6
32 Groshen		a Specie-dollar -	0	4	8
4 Goulds		a Ducat - -	0	9	4

BRANDENBURGH AND POMERANIA.

Berlin, Potsdam, &c. Stetin, &c.

			£.	s.	d.
†A Denier	=	- -	0	0	0[illegible]
9 Deniers		a Polchen -	0	0	$0\frac{7}{30}$
18 Deniers		a Grosh - -	0	0	$0\frac{7}{15}$
3 Polchens		an Abrass -	0	0	$0\frac{7}{10}$
20 Groshen		†a Marc -	0	0	$9\frac{1}{3}$

EUROPE, Northern Parts. GERMANY.

BRANDENBURGH, &c.

			£.	s.	d.
30 Groſhen		a Florin	0	1	2
90 Groſhen		†a Rix-dollar	0	3	6
108 Groſhen		an Albertus	0	4	2
8 Florins		a Ducat	0	9	4

COLOGN, *Mentz, Triers, Liege, Munich, Munſter, Paderbourn, &c.*

			£.	s.	d.
A Dute			0	0	$0\frac{7}{80}$
3 Dutes	=	a Cruitzer	0	0	$0\frac{21}{80}$
2 Cruitzers		an Albus	0	0	$0\frac{21}{40}$
8 Dutes		a Stiver	0	0	$0\frac{7}{10}$
3 Stivers		a Plapert	0	0	$2\frac{1}{10}$
4 Playperts		a Copſtuck	0	0	$8\frac{2}{5}$
40 Stivers		a Guilder	0	2	4
2 Guilders		a Hard Dollar	0	4	8
4 Guilders		a Ducat	0	9	4

BOHEMIA, SILESIA, AND HUNGARY.

Prague, Breſlaw, Preſburg, &c.

			£.	s.	d.
A Fening			0	0	$0\frac{7}{60}$
2 Fenings	=	a Dreyer	0	0	$0\frac{3}{30}$
3 Fenings		a Groſh	0	0	$0\frac{7}{20}$
4 Fenings		a Cruitzer	0	0	$0\frac{7}{15}$
2 Cruitzers		a White Groſh	0	0	$0\frac{14}{15}$
60 Cruitzers		a Gould	0	2	4
90 Cruitzers		†a Rix-dollar	0	3	6
2 Goulds		a Hard Dollar	0	4	8
4 Goulds		a Ducat	0	9	4

AUSTRIA AND SWABIA.

Vienna, Tieſt, &c. Auſburg, Blenheim, &c.

			£.	s.	d.
A Fening			0	0	$0\frac{7}{60}$
2 Fenings	=	a Dreyer	0	0	$0\frac{7}{30}$
4 Fenings		a Cruitzer	0	0	$0\frac{7}{15}$
14 Fenings		a Groſh	0	0	$1\frac{19}{20}$
4 Cruitzers		a Batzen	0	0	$1\frac{13}{15}$
15 Batzen		a Gould	0	2	4
90 Cruitzers		†a Rix-dollar	0	3	6
30 Batzen		a Specie-dollar	0	4	8
60 Batzen		a Ducat	0	9	4

FRANCONIA, *Francfort, Nuremburg, Dettingen, &c.*

			£.	s.	d.
A Fening			0	0	$0\frac{7}{60}$
4 Fenings	=	a Cruitzer	0	0	$0\frac{7}{15}$
3 Cruitzers		a Keyſer Groſh	0	0	$1\frac{2}{5}$
4 Cruitzers		a Batzen	0	0	$1\frac{11}{15}$
15 Cruitzers		an Ort Gould	0	0	7
60 Cruitzers		a Gould	0	2	4
90 Cruitzers		†a Rix-dollar	0	3	6
2 Goulds		a Hard Dollar	0	4	8
240 Cruitzers		a Ducat	0	9	4

POLAND AND PRUSSIA.

Cracow, Warſaw, &c. Dantzic, Koningſberg, &c.

			£.	s.	d.
A Shelon			0	0	$0\frac{7}{45}$
3 Shelons	=	a Groſh	0	0	$0\frac{7}{15}$
5 Groſhen		a Couſtic	0	0	$2\frac{1}{3}$
3 Couſtics		a Tinſe	0	0	7

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EUROPE, Northern Parts.

POLAND, &c.

			£.	s.
18 Groſhen	=	an Ort	0	0
30 Groſhen		a Florin	0	1
90 Groſhen		†a Rix dollar	0	3
8 Florins		a Ducat	0	9
5 Rix-dollars		a Frederic d'Or	0	17

LIVONIA.

Riga, Revel, Narva, &c.

A Blacken			0	0
6 Blackens	=	a Groſh	0	0
9 Blackens		a Vording	0	0
2 Groſhen		a Whiten	0	0
6 Groſhen		a Marc	0	0
30 Groſhen		a Florin	0	1
90 Groſhen		† a Rix dollar	0	3
108 Groſhen		an Albertus	0	4
64 Whitens		a Copper-plate Dollar	0	5

DENMARK, ZEALAND, AND NORWAY.

Copenhagen, Sound, &c. Bergen, Drontheim, &c.

A Skilling			0	0
6 Skillings	=	a Duggen	0	0
16 Skillings		† a Marc	0	0
20 Skillings		a Rix-marc	0	0
24 Skillings		a Rix ort	0	1
4 Marcs		a Crown	0	3
6 Marcs		a Rix dollar	0	4
11 Marcs		a Ducat	0	8
14 Marcs		a Hatt Ducat	0	10

SWEDEN AND LAPLAND.

Stockholm, Upſal, &c. Thorn, &c.

† A Runſtick			0	0
2 Runſticks	=	a Stiver	0	0
8 Runſticks		a Copper Marc	0	0
3 Copper Marcs		a Silver Marc	0	0
4 Copper Marcs		a Copper Dollar	0	0
9 Copper Marcs		a Caroline	0	1
3 Copper Dollars		a Silver Dollar	0	1
3 Silver Dollars		a Rix-dollar	0	4
2 Rix dollars		a Ducat	0	9

RUSSIA AND MUSCOVY.

Peterſburg, Archangel, &c. Muſcow, &c.

A Poluſca			0	0
2 Poluſcas	=	a Denuſca	0	0
2 Denuſcas		†a Copec	0	0
3 Copecs		an Altin	0	0
10 Copecs		a Grievener	0	0
25 Copecs		a Polpotin	0	1
50 Copecs		a Poltin	0	2
100 Copecs		a Ruble	0	4
2 Rubles		a Xervonitz	0	9

BASIL. *Zurich, Zug, &c.*

A Rap			0	0
3 Rapen	=	a Fening	0	0
4 Fenings		a Cruitzer	0	0
12 Fenings		†a Sol	0	0

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EUROPE, Southern Parts.

BASIL, &c.

			£.	s.	d.
15 Fenings	=	a Coarſe Batzen	0	0	1 $\frac{7}{8}$
18 Fenings		a Good Batzen	0	0	2 $\frac{1}{4}$
20 Sols		†a Livre -	0	2	6
60 Cruitzers		a Gulden -	0	2	6
108 Cruitzers		a Rix-dollar	0	4	6

St GALL. *Apenſal*, &c.

			£.	s.	d.
An Heller		- -	0	0	0 $\frac{1}{16}$
2 Hellers	=	a Fening -	0	0	0 $\frac{1}{8}$
4 Fenings		a Cruitzer -	0	0	0 $\frac{1}{2}$
12 Fenings		† a Sol -	0	0	0 $\frac{1}{2}$
4 Cruitzers		a Coarſe Batzen	0	0	2
5 Cruitzers		a Good Batzen	0	0	2 $\frac{1}{2}$
20 Sols		†a Livre -	0	2	6
60 Cruitzers		a Gould -	0	2	6
102 Cruitzers		a Rix-dollar	0	4	3

BERN. *Lucern*, *Neufchatel*, *&c.*

			£.	s.	d.
A Denier		- -	0	0	0 $\frac{1}{10}$
4 Deniers	=	a Cruitzer -	0	0	0 $\frac{2}{5}$
3 Cruitzers		†a Sol -	0	0	1 $\frac{1}{5}$
4 Cruitzers		a Plapert -	0	0	1 $\frac{3}{5}$
5 Cruitzers		a Gros -	0	0	2
6 Cruitzers		a Batzen -	0	0	2 $\frac{2}{5}$
20 Sols		†a Livre -	0	2	0
75 Cruitzers		a Gulden -	0	2	6
135 Cruitzers		a Crown -	0	4	6

GENEVA. *Pekay*, *Bonne*, &c.

			£.	s.	d.
A Denier		- -	0	0	0 $\frac{1}{32}$
2 Deniers	=	a Denier current	0	0	0 $\frac{1}{16}$
12 Deniers		a Small Sol	0	0	0 $\frac{3}{8}$
12 Deniers current		a Sol current	0	0	0 $\frac{3}{4}$
12 Small Sols		†a Florin -	0	0	4 $\frac{1}{2}$
20 Sols current		†a Livre current	0	1	3
10$\frac{1}{2}$ Florins		a Patacon -	0	3	11 $\frac{1}{4}$
15$\frac{3}{4}$ Florins		a Croiſade -	0	5	10 $\frac{7}{8}$
24 Florins		a Ducat -	0	9	0

Liſle, *Cambray*, *Valenciennes*, &c.

			£.	s.	d.
A Denier		- - -	0	0	0 $\frac{1}{24}$
12 Deniers	=	a Sol -	0	0	0 $\frac{1}{2}$
15 Deniers		†a Patard -	0	0	0 $\frac{5}{8}$
15 Patards		†a Piette -	0	0	9 $\frac{3}{4}$
20 Sols		a Livre Tournois	0	0	10
20 Patards		†a Florin -	0	1	0 $\frac{1}{2}$
60 Sols		an Ecu of Ex.	0	2	6
10$\frac{1}{2}$ Livres		a Ducat -	0	9	3
24 Livres		a Louis d'Or	1	0	0

Dunkirk, *St Omers*, *St Quintin*, &c.

			£.	s.	d.
A Denier		- -	0	0	0 $\frac{1}{24}$
12 Deniers	=	a Sol -	0	0	0 $\frac{1}{2}$
15 Deniers		†a Patard -	0	0	0 $\frac{5}{8}$
15 Sols		†a Piette -	0	0	7 $\frac{1}{2}$
20 Sols		†a Livre Tournois	0	0	10
3 Livres		an Ecu of Ex.	0	2	6
24 Livres		a Louis d'Or	1	0	0
25$\frac{1}{2}$ Livres		a Guinea -	1	1	0
32$\frac{2}{5}$ Livres		a Moeda -	1	7	0

Paris, *Lyons*, *Marſeilles*, *&c.* *Bourdeaux*, *Bayonne*, *&c.*

			£.	s.	d.
A Denier		- -	0	0	0 $\frac{1}{24}$
3 Deniers	=	a Liard -	0	0	0 $\frac{1}{8}$
2 Liards		a Dardene -	0	0	0 $\frac{1}{4}$
12 Deniers		a Sol -	0	0	0 $\frac{1}{2}$
20 Sols		†a Livre Tournois	0	0	10
60 Sols		an Ecu of Ex.	0	2	6
6 Livres		an Ecu	0	5	0
10 Livres		†a Piſtole -	0	8	4
24 Livres		a Louis d'Or	1	0	0

PORTUGAL. *Liſbon*, *Oporto*, *&c.*

			£.	s.	d.
† A Re		- - -	0	0	0 $\frac{27}{400}$
10 Rez	=	a Half Vintin -	0	0	0 $\frac{27}{40}$
20 Rez		a Vintin -	0	0	1 $\frac{7}{20}$
5 Vintins		a Teſtoon -	0	0	6 $\frac{3}{4}$
4 Teſtoons		a Cruſade of Ex.	0	2	3
24 Vintins		a New Cruſade -	0	2	8 $\frac{2}{5}$
10 Teſtoons		†a Milre - -	0	5	7 $\frac{1}{2}$
48 Teſtoons		a Moeda - -	1	7	0
64 Teſtoons		a Joaneſe -	1	16	0

Spain and Catalonia.

Madrid, *Cadiz*, *Seville*, *&c.* *New Plate.*

			£.	s.	d.
A Maravedie		- -	0	0	0 $\frac{43}{272}$
2 Maravedies	=	a Quartil -	0	0	0 $\frac{43}{136}$
34 Maravedies		a Rial -	0	0	5 $\frac{3}{8}$
2 Rials		a Piſtarine	0	0	10 $\frac{3}{4}$
8 Rials		†a Piaſtre of Ex.	0	3	7
10 Rials		a Dollar -	0	4	6
375 Maravedies		†a Ducat of Ex.	0	4	11 $\frac{1}{4}$
32 Rials		†a Piſtole of Ex.	0	14	4
36 Rials		a Piſtole -	0	16	9

Gibraltar, *Malaga*, *Denia*, *&c.* *Velon.*

			£.	s.	d.
† A Maravedie		- - -	0	0	0 $\frac{23}{272}$
2 Maravedies	=	a Ochavo	0	0	0 $\frac{23}{136}$
4 Maravedies		a Quartil	0	0	0 $\frac{23}{68}$
34 Maravedies		†a Rial Velon	0	0	2 $\frac{7}{8}$
15 Rials		†a Piaſtre of Ex.	0	3	7
512 Maravedies		a Piaſtre	0	3	7
60 Rials		†a Piſtole of Ex.	0	14	4
2048 Maravedies		a Piſtole of Ex.	0	16	9
78 Rials		a Piſtole -	0	16	9

Barcelona, *Saragoſſa*, *Valencia*, *&c.* *Old Plate.*

			£.	s.	d.
A Maravedie		- -	0	0	0 $\frac{27}{128}$
16 Maravedies	=	a Soldo -	0	0	3 $\frac{3}{8}$
2 Soldos		a Rial Old Plate	0	0	6 $\frac{3}{4}$
20 Soldos		†a Libra -	0	5	7 $\frac{1}{2}$
24 Soldos		†a Ducat -	0	6	9
16 Soldos		†a Dollar -	0	4	6
22 Soldos		†a Ducat -	0	6	2 $\frac{1}{4}$
21 Soldos		†a Ducat -	0	5	10 $\frac{7}{8}$
60 Soldos		a Piſtole -	0	16	9

Italy.

GENOA. *Novi*, &c. CORSICA. *Baſtia*, &c.

			£.	s.	d.
A Denari		- - - -	0	0	0 $\frac{43}{1200}$
12 Denari	=	a Soldi -	0	0	0 $\frac{43}{100}$
4 Soldi		a Chevalet	0	0	1 $\frac{18}{25}$
20 Soldi		† a Lire -	0	0	8 $\frac{3}{5}$
30 Soldi		a Teſtoon	0	1	0 $\frac{9}{10}$

EUROPE, Southern Parts. ITALY.

GENOA, &c.

			£.	s.	d.
5 Lires	=	a Croisade	0	3	7
115 Soldi		†a Pezzo of Ex.	0	4	2
6 Testoons		a Genouine	0	6	2
20 Lires		a Pistole -	0	14	4

PIEDMONT, SAVOY, AND SARDINIA.

Turin, Chamberry, Cagliari, &c.

			£.	s.	d.
A Denari		- - - -	0	0	0 $\frac{1}{16}$
3 Denari	=	a Quatrini -	0	0	0 $\frac{3}{16}$
12 Denari		a Soldi -	0	0	0 $\frac{3}{4}$
12 Soldi		†a Florin -	0	0	9
20 Soldi		†a Lire -	0	1	3
6 Florins		a Scudi -	0	4	6
7 Florins		a Ducatoon -	0	5	3
13 Lires		a Pistole -	0	16	3
16 Lires		a Louis d'Or	1	0	0

Milan, Modena, Parma, Pavia, &c.

			£.	s.	d.
A Denari		- - -	0	0	0 $\frac{3}{82}$
3 Denari	=	a Quatrini -	0	0	0 $\frac{9}{82}$
12 Denari		a Soldi -	0	0	0 $\frac{18}{41}$
20 Soldi		†a Lire -	0	0	8 $\frac{32}{41}$
115 Soldi		a Scudi current	0	4	2 $\frac{1}{2}$
117 Soldi		†a Scudi of Ex.	0	4	3
6 Lires		a Philip -	0	4	4 $\frac{1}{2}$
22 Lires		a Pistole -	0	16	0
23 Lires		a Spanish Pistole	0	16	9

Leghorn, Florence, &c.

			£.	s.	d.
A Denari		- - -	0	0	0 $\frac{5}{144}$
4 Denari	=	a Quatrini -	0	0	0 $\frac{5}{36}$
12 Denari		a Soldi -	0	0	0 $\frac{5}{12}$
5 Quatrini		a Craca -	0	0	0 $\frac{25}{36}$
8 Cracas		a Quilo -	0	0	5 $\frac{5}{9}$
20 Soldi		†a Lire -	0	0	8 $\frac{1}{3}$
6 Lires		a Piastre of Ex.	0	4	2
7½ Lires		a Ducat -	0	5	2 $\frac{1}{2}$
22 Lires		a Pistole -	0	15	6

ROME, *Civita Vecchia, Ancona.*

			£.	s.	d.
A Quatrini		- - -	0	0	0 $\frac{3}{20}$
5 Quatrini	=	a Bayoc -	0	0	0 $\frac{3}{4}$
8 Bayocs		a Julio -	0	0	6
10 Bayocs		a Stampt Julio	0	0	7 $\frac{1}{2}$
24 Bayocs		a Testoon -	0	1	6
10 Julios		a Crown current	0	5	0
12 Julios		†a Crown stampt	0	6	0
18 Julios		a Chequin -	0	9	0
31 Julios		a Pistole -	0	15	6

NAPLES. *Gaieta, Capua, &c.*

			£.	s.	d.
A Quatrini		- - -	0	0	0 $\frac{2}{15}$
3 Quatrini	=	a Grain -	0	0	0 $\frac{2}{5}$
10 Grains		a Carlin -	0	0	4
40 Quatrini		a Paulo -	0	0	5 $\frac{1}{3}$
20 Grains		a Tarin -	0	0	8
40 Grains		a Testoon -	0	1	4
100 Grains		a Ducat of Ex.	0	3	4
23 Tarins		a Pistole -	0	15	4
25 Tarins		a Spanish Pistole	1	16	9

EUROPE, Southern Parts. ITALY.

SICILY and MALTA. *Palermo, Messina, &c.*

			£.	s.	
A Pichila		- -	0	0	0
6 Pichili	=	a Grain -	0	0	0
8 Pichili		a Ponti -	0	0	0
10 Grains		a Carlin -	0	0	1
20 Grains		a Tarin -	0	0	3
6 Tarins		†a Florin of Ex.	0	1	6
13 Tarins		a Ducat of Ex.	0	3	4
60 Carlins		†an Ounce -	0	7	8
2 Ounces		a Pistole -	0	15	4

Bologna, Ravenna, &c.

A Quatrini		- - -	0	0	0
6 Quatrini	=	a Bayoc -	0	0	0
10 Bayocs		†a Julio -	0	0	6
20 Bayocs		a Lire -	0	1	0
3 Julios		a Testoon -	0	1	6
80 Bayocs		a Schudi of Ex.	0	4	3
105 Bayocs		a Ducatoon -	0	5	3
100 Bayocs		a Crown -	0	5	0
31 Julios		a Pistole -	0	15	6

VENICE. *Bergham, &c.*

A Picoli		- - -	0	0	0
12 Picoli	=	a Soldi -	0	0	0
6¼ Soldi		†a Gros -	0	0	2
18 Soldi		a Jule - -	0	0	6
20 Soldi		†a Lire -	0	0	6
3 Jules		a Testoon -	0	1	6
124 Soldi		a Ducat current	0	3	5
24 Gros		†a Ducat of Ex.	0	4	4
17 Lires		a Chequin -	0	9	2

ASIA.

TURKEY. *Morea, Candia, Cyprus, &c.*

A Mangar		- - -	0	0	0
4 Mangars	=	†an Asper -	0	0	0
3 Aspers		a Parac - -	0	0	1
5 Aspers		a Bestic - -	0	0	3
10 Aspers		an Ostic -	0	0	6
20 Aspers		a Solota - -	0	1	0
80 Aspers		†a Piastre -	0	4	0
100 Aspers		a Caragrouch -	0	5	0
10 Solotas		a Xeriff -	0	10	0

ARABIA. *Medina, Mecca, Mocha, &c.*

A Carret		- - -	0	0	0
5½ Carrets	=	a Caveer -	0	0	0
7 Carrets		a Comashee -	0	0	0
80 Carrets		a Larin -	0	0	10
18 Comashees		an Abyss -	0	1	4
60 Comashees		†a Piastre -	0	4	6
80 Caveers		a Dollar - -	0	4	6
100 Comashees		a Sequin - -	0	7	6
80 Larins		†a Tomond -	3	7	6

PERSIA. *Ispahan, Ormus, Gombroon, &c.*

A Coz		- - -	0	0	0
4 Coz	=	a Bisti -	0	0	1
10 Coz		a Shahee - -	0	0	4
20 Coz		a Mamooda -	0	0	8
25 Coz		a Larin - -	0	0	10
4 Shahees		an Abashee -	0	1	4

5 Abash[...]

			£.	s.	d.
Abaſhees	=	an Or	0	8	6
Abaſhees		a Bovello	0	16	0
Abaſhees		†a Tomond	3	6	8

GUZZURAT. *Surat, Cambay, &c.*

			£.	s.	d.
A Pecka			0	0	$0\frac{15}{64}$
2 Peckas	=	a Pice	0	0	$0\frac{15}{32}$
4 Pices		a Fanam	0	0	$1\frac{7}{8}$
5 Pices		a Viz	0	0	$2\frac{11}{32}$
10 Pices		an Ana	0	0	$7\frac{1}{2}$
4 Anas		a Rupee	0	2	6
2 Rupees		an Engliſh Crown	0	5	0
14 Anas		a Pagoda	0	8	9
4 Pagodas		a Gold Rupee	1	15	0

MALABAR.

Bombay, Dabul, &c.

			£.	s.	d.
†A Budgrook			0	0	$0\frac{27}{800}$
2 Budgrooks	=	†a Re	0	0	$0\frac{27}{400}$
5 Rez		a Pice	0	0	$0\frac{27}{80}$
16 Pices		a Laree	0	0	$5\frac{2}{5}$
20 Pices		a Quarter	0	0	$6\frac{3}{4}$
240 Rez		a Xeraphim	0	1	$4\frac{1}{5}$
4 Quarters		a Rupee	0	2	3
14 Quarters		a Pagoda	0	8	0
60 Quarters		a Gold Rupee	1	15	0

Goa, Viſapour, &c.

			£.	s.	d.
†A Re			0	0	$0\frac{27}{400}$
2 Rez	=	a Bazaraco	0	0	$0\frac{27}{200}$
2 Bazaracos		a Pecka	0	0	$0\frac{27}{100}$
20 Rez		a Vintin	0	0	$1\frac{7}{20}$
4 Vintins		a Laree	0	0	$5\frac{2}{5}$
3 Larees		a Xeraphim	0	1	$4\frac{1}{5}$
42 Vintins		a Tangu	0	4	6
4 Tangus		a Paru	0	18	0
8 Tangus		a Gold Rupee	1	15	0

COROMANDEL. *Madraſs, Pondicherry, &c.*

			£.	s.	d.
A caſh			0	0	$0\frac{5}{32}$
5 Caſh	=	a Viz	0	0	$0\frac{3}{16}$
2 Viz		a Pice	0	0	$0\frac{3}{8}$
6 Pices		a Pical	0	0	$2\frac{1}{4}$
8 Pices		a Fanam	0	0	3
10 Fanams		a Rupee	0	2	6
2 Rupees		an Engliſh Crown	0	5	0
36 Fanams		a Pagoda	0	8	9
4 Pagodas		a Gold Rupee	1	15	0

BENGAL. *Callicut, Calcutta, &c.*

			£.	s.	d.
A Pice			0	0	$0\frac{5}{32}$
4 Pices	=	a Fanam	0	0	$0\frac{5}{8}$
6 Pices		a Viz	0	0	$0\frac{15}{16}$
12 Pices		an Ana	0	0	$1\frac{7}{8}$
10 Anas		a Fiano	0	1	$6\frac{3}{4}$
16 Anas		a Rupee	0	2	6
2 Rupees		a French Ecu	0	5	0
2 Rupees		an Engliſh Crown	0	5	0
56 Anas		a Pagoda	0	8	9

ASIA.

SIAM. *Pegu, Malacca, Cambodia, Sumatra, Java, Borneo, &c.*

			£.	s.	d.
A Cori			0	0	$0\frac{3}{40000}$
800 Cori	=	a Fettee	0	0	$0\frac{3}{50}$
125 Fettees		a Sataleer	0	0	$7\frac{1}{2}$
250 Fettees		a Sooco	0	1	3
500 Fettees		a Tutal	0	2	6
900 Fettees		a Dollar	0	4	6
2 Ticals		a Rial	0	5	0
4 Soocos		an Ecu	0	5	0
8 Sateleers		a Crown	0	5	0

CHINA. *Pekin, Canton, &c.*

			£.	s.	d.
A Caxa			0	0	$0\frac{2}{25}$
10 Caxa	=	a Candereen	0	0	$0\frac{4}{5}$
10 Candereens		a Mace	0	0	8
35 Candereens		a Rupee	0	2	6
2 Rupees		a Dollar	0	4	6
70 Candereens		a Rix-dollar	0	4	$4\frac{1}{2}$
7 Maces		an Ecu	0	5	0
2 Rupees		a Crown	0	5	0
10 Maces		†a Tale	0	6	8

JAPAN. *Jedda, Meaco, &c.*

			£.	s.	d.
A Piti			0	0	$0\frac{1}{5}$
20 Pitis	=	a Mace	0	0	4
15 Maces		an Ounce Silver	0	4	$10\frac{1}{3}$
20 Maces		a Tale	0	6	8
30 Maces		an Ingot	0	9	$8\frac{2}{3}$
13 Ounces Silver		an Ounce Gold	3	3	0
2 Ounces Gold		a Japaneſe	6	6	0
2 Japaneſes		a Double	12	12	0
21 Ounces Gold		†a Cattee	66	3	0

AFRICA.

EGYPT. *Old and New Cairo, Alexandria, Sayde, &c.*

			£.	s.	d.
An Aſper			0	0	$0\frac{5}{9}$
3 Aſpers	=	a Medin	0	0	$1\frac{2}{3}$
24 Medins		an Italian Ducat	0	3	4
80 Aſpers		†a Piaſtre	0	4	0
30 Medins		a Dollar	0	4	6
96 Aſpers		an Ecu	0	5	0
32 Medins		a Crown	0	5	0
200 Aſpers		a Sultanin	0	10	0
70 Medins		a Pargo Dollar	0	10	0

BARBARY. *Algiers, Tunis, Tripoli, Una, &c.*

			£.	s.	d.
An Aſper			0	0	$0\frac{5}{9}$
3 Aſpers	=	a Medin	0	0	$1\frac{2}{3}$
10 Aſpers		a Rial old Plate	0	0	$6\frac{3}{4}$
2 Rials		a Double	0	1	$1\frac{1}{2}$
4 Doubles		a Dollar	0	4	6
24 Medins		a Silver Chequin	0	3	4
30 Medins		a Dollar	0	4	6
180 Aſpers		a Zequin	0	8	10
15 Doubles		a Piſtole	0	16	9

MOROCCO. *Santa Cruz, Mequinez, Fez, Tangiers, Sallee, &c.*

			£.	s.	d.
A Fluce			0	0	$0\frac{1}{12}$
24 Fluces	=	a Blanquil	0	0	2

AFRICA.

MOROCCO, &c.

			£.	s.	d.
4 Blanquils	=	an Ounce - -	0	0	8
7 Blanquils		an Octavo -	0	1	2
14 Blanquils		a Quarto -	0	2	4
2 Quartos		a Medio -	0	4	8
28 Blanquils		a Dollar - -	0	4	6
54 Blanquils		a Xequin -	0	9	0
100 Blanquils		a Pistole - -	0	16	9

AMERICA. WEST-INDIES.

ENGLISH. *Jamaica, Barbadoes, &c.*

†Halfpenny		- -	0	0	$0\frac{57}{160}$
2 Halfpence	=	†a Penny	0	0	$0\frac{57}{80}$
$7\frac{1}{2}$ Pence		a Bit -	0	0	$5\frac{3}{8}$
12 Pence		†a Shilling	0	0	$8\frac{11}{20}$
75 Pence		a Dollar	0	4	6
7 Shillings		a Crown	0	5	0
20 Shillings		†a pound	0	14	3
24 Shillings		a Pistole	0	16	9
30 Shillings		a Guinea	1	1	0

FRENCH. *St Domingo, Martinico, &c.*

†A Half Sol		- - -	0	0	$0\frac{117}{640}$
2 Half Sols	=	†a Sol -	0	0	$0\frac{117}{320}$
$7\frac{1}{2}$ Sols		a Half Scalin	0	0	$2\frac{11}{16}$
15 Sols		a Scalin	0	0	$5\frac{3}{8}$
20 Sols		†a livre	0	0	$7\frac{5}{16}$
7 Livres		a Dollar	0	4	6
8 Livres		an Ecu	0	4	$10\frac{1}{2}$
26 Livres		a Pistole	0	16	9
32 Livres		a Louis d'Or	1	0	0

AMERICA. CONTINENT.

ENGLISH. *Nova Scotia, Virginia, New England, &c.*

			£.	s.
†A Penny		- -	0	0
12 Pence	=	†a Shilling -	0	1
20 Shillings		†a Pound -	1	0
2 Pounds				
3 Pounds				
4 Pounds				
5 Pounds				
6 Pounds				
7 Pounds				
8 Pounds				
9 Pounds				
10 Pounds				

The value of the Currency ters according to the Plenty Scarcity of Gold and Silver C that are imported.

Canada, Florida, Cayena, &c.

† A Denier		
12 Deniers	=	†a Sol.
20 Sols		†a Livre.
2 Livres		
3 Livres		
4 Livres		
5 Livres		
6 Livres		
7 Livres		
8 Livres		
9 Livres		
10 Livres		

The value of the Currency ters according to the Plenty Scarcity of Gold and Silver C that are imported.

Note. For all the *Spanish*, *Portuguese*, *Dutch*, and *Da* Dominions, either on the Continent or in the West Indies, the Moneys of the respective nations.

Ancient Money. See COINS and MEDALS.

Paper Money. See the article BANK.

Mongault.

MONGAULT (Nicholas Hubert), an ingenious and learned Frenchman, and one of the best writers of his time, was born at Paris in 1674. At 16 he entered into the congregation of the fathers of the oratory, and was afterwards sent to Mans to learn philosophy. That of Aristotle then obtained in the schools, and was the only one which was permitted to be taught: nevertheless Mongault, with some of that original spirit which usually distinguishes men of uncommon abilites from the vulgar, ventured in a public thesis which he read at the end of the course of lectures, to oppose the opinions of Aristotle, and to maintain those of Des Cartes. Having studied theology with the same success, he quitted the oratory in 1699; and soon after went to Thoulouse, and lived with Colbert archbishop of that place, who had procured him a priory in 1698. In 1710 the duke of Orleans, regent of the kingdom, committed to him the education of his son the duke of Chartres; which important office he discharged so well, that he acquired an universal esteem. In 1714, he had the abbey of Chartreuve given him, and that of Villeneuve in 1719. The duke of Chartres, becoming colonel-general of the French infantry, chose the Abbé Mongault to fill the place of secretary-general; made him also secretary of the province of Dauphiny; and, after the death of the regent his father, raised him to other considerable employments. All this while he was as assiduous as his engagements would permit in cultivating polite literature; and, in 1714, published at Paris, in 6 vols. 12mo, an edition of Tully's Letters to Atticus, with an excellent French translation, and judicious comment upon them. This work has been often reprinted, and is justly reckoned admirable; for, as Middleton has observed, in the preface to his Life of Cicero, the Abbé Mongault "did not content himself with retailing the remarks of other commentators, or out of the rubbish of their volumes with selecting the best, but entered upon his task with the spirit of a true critic, and by the force of his own genius has happily illustrated many passages which all the interpreters before him had given up as inexplicable." He published also a very good translation of Herodian from the Greek; the best edition of which is that of 1745, in 12mo. He died at Paris in 1746. He was a member of the French academy, and of the academy of inscriptions and belles lettres; and was fitted to do honour to any society.

Mongo Monk

MONGOOZ, in zoology. See LEMUR.

MONK anciently denoted, "a person who retired from

from the world to give himfelf up wholly to God, and to live in folitude and abftinence." The word is derived from the Latin *monachus*, and that from the Greek μοναχος, "folitary;" of μονος *folus*, "alone."

The original of monks feems to have been this: The perfecutions which attended the firft ages of the Gofpel forced fome Chriftians to retire from the world, and live in defarts and places moft private and unfrequented, in hopes of finding that peace and comfort among beafts which were denied them among men. And this being the cafe of fome very extraordinary perfons, their example gave fo much reputation to retirement, that the practice was continued when the reafon of its commencement ceafed. After the empire became Chriftian, inftances of this kind were numerous; and thofe whofe fecurity had obliged them to live feparately and apart, became afterwards united into focieties. We may alfo add, that the myftic theology, which gained ground towards the clofe of the third century, contributed to produce the fame effect, and to drive men into folitude for the purpofes of enthufiaftic devotion.

The monks, at leaft the ancient ones, were diftinguifhed into *folitaires*, *cœnobites*, and *farabaites*.

The *folitary* are thofe who live alone, in places remote from all towns and habitations of men, as do ftill fome of the hermits.—The *cœnobites* are thofe who live in community with feveral others in the fame houfe, and under the fame fuperiors.—The *farabaites* were ftrolling monks, having no fixed rule or refidence.

The houfes of monks again were of two kinds, viz. *monafteries* and *lauræ*. See MONASTERY and LAURA.

Thofe we call monks now-a-days are cœnobites, who live together in a convent or monaftery, who make vows of living according to a certain rule eftablifhed by the founder, and wear a habit which diftinguifhes their order.

Thofe that are endowed, or have a fixed revenue, are moft properly called monks, *monachi;* as the Chartreux, Benedictines, Bernardines, &c. The Mendicants, or thofe that beg, as the Capuchins and Francifcans, are more properly called *religious* and *friars;* though the names are frequently confounded.

The firft monks were thofe of St Antony; who, towards the clofe of the fourth century, formed them into a regular body, engaged them to live in fociety with each other, and prefcribed to them fixed rules for the direction of their conduct. Thefe regulations, which Antony had made in Egypt, were foon introduced into Paleftine and Syria by his difciple Hilarion. Almoft about the fame time, Aones or Eugenius, with their companions Gaddanas and Azyzas, inftituted the monaftic order in Mefopotamia and the adjacent countries; and their example was followed with fuch rapid fuccefs, that in a fhort time the whole eaft was filled with a lazy fet of mortals, who, abandoning all human connections, advantages, pleafures, and concerns, wore out a languifhing and miferable life amidft the hardfhips of want, and various kinds of fuffering, in order to arrive at a more clofe and rapturous communication with God and angels.

From the eaft this gloomy inftitution paffed into the weft, and firft into Italy and its neighbouring iflands; though it is uncertain who tranfplanted it thither. St Martin, the celebrated bifhop of Tours, erected the firft monafteries in Gaul, and recommended this religious folitude with fuch power and efficacy, both by his inftructions and his example, that his funeral is faid to have been attended by no lefs than 2000 monks. From hence the monaftic difcipline extended gradually its progrefs through the other provinces and countries of Europe. There were befides the monks of St Bafil (called in the eaft *Calogeri*, from καλος γερων "good old man") and thofe of St Jerom, the hermits of St Auguftine, and afterwards thofe of St Benedict and St Bernard; at length came thofe of St Francis and St Dominic, with a legion of others; all which fee under their proper heads, BENEDICTINES, &c.

Towards the clofe of the 5th century, the monks, who had formerly lived only for themfelves in folitary retreats, and had never thought of affuming any rank among the facerdotal order, were now gradually diftinguifhed from the populace, and endowed with fuch opulence and honourable privileges, that they found themfelves in a condition to claim an eminent ftation among the fupports and pillars of the Chriftian community. The fame of their piety and fanctity was fo great, that bifhops and prefbyters were often chofen out of their order; and the paffion of erecting edifices and convents, in which the monks and holy virgins might ferve God in the moft commodious manner, was at this time carried beyond all bounds However, their licentioufnefs, even in this century, was become a proverb; and they are faid to have excited the moft dreadful tumults and feditions in various places. The monaftic orders were at firft under the immediate jurifdiction of the bifhops, from which they were exempted by the Roman pontiff about the end of the 7th century; and the monks, in return, devoted themfelves wholly to advance the interefts and to maintain the dignity of the bifhop of Rome. This immunity which they obtained was a fruitful fource of licentioufnefs and diforder, and occafioned the greateft part of the vices with which they were afterwards fo juftly charged. In the 8th century the monaftic difcipline was extremely relaxed both in the eaftern and weftern provinces, and all efforts to reftore it were ineffectual. Neverthelefs, this kind of inftitution was in the higheft efteem, and nothing could equal the veneration that was paid about the clofe of the 9th century to fuch as devoted themfelves to the facred gloom and indolence of a convent. This veneration induced feveral kings and emperors to call them to their courts, and to employ them in civil affairs of the greateft moment. Their reformation was attempted by Louis the Meek, but the effect was of fhort duration. In the 11th century they were exempted by the popes from the authority of their fovereigns, and new orders of monks were continually eftablifhed; infomuch that in the council of Lateran that was held in the year 1215, a decree was paffed, by the advice of Innocent III. to prevent any new monaftic inftitutions; and feveral were entirely fuppreffed. In the 15th and 16th centuries, it appears, from the teftimonies of the beft writers, that the monks were generally lazy, illiterate, profligate, and licentious Epicureans, whofe views in life were confined to opulence, idlenefs, and pleafure. However, the Reformation had a manifeft influence

influence in restraining their excesses, and rendering them more circumspect and cautious in their external conduct.

Monks are distinguished by the colour of their habits into *black*, *white*, *grey*, &c. Among the monks, some are called *monks of the choir*, others *professed monks*, and others *lay monks*; which last are destined for the service of the convent, and have neither clericate nor literature.

Cloistered Monks, are those who actually reside in the house; in opposition to *extra*-monks, who have benefices depending on the monastery.

Monks are also distinguished into *reformed*, whom the civil and ecclesiastical authority have made masters of ancient convents, and put in their power to retrieve the ancient discipline, which had been relaxed; and *ancient*, who remain in the convent, to live in it according to its establishment at the time when they made their vows, without obliging themselves to any new reform.

Anciently the monks were all laymen, and were only distinguished from the rest of the people by a particular habit and an extraordinary devotion. Not only the monks were prohibited the priesthood, but even priests were expressly prohibited from becoming monks, as appears from the letters of St Gregory. Pope Syricius was the first who called them to the clericate, on occasion of some great scarcity of priests, that the church was then supposed to labour under: and since that time, the priesthood has been usually united to the monastical profession.

Monk (George), a personage memorable for having been the principal agent in restoring Charles II. to his crown, was descended from a very ancient family, and born in Devonshire in 1608. Being an unprovided younger son, he dedicated himself to arms from his youth, and obtained a pair of colours in the expedition to the Isle of Rhée: he served afterwards in the Low Countries with reputation in both King Charles's northern expeditions; and did such service in quelling the Irish rebellion, that he was appointed governor of Dublin, but was superseded by parliamentary authority. Being made major-general of the Irish brigade employed in the siege of Nantwich in Cheshire, he was taken prisoner by Sir Thomas Fairfax, and remained confined in the Tower of London until the year 1646; when, as the means of liberty, he took the covenant, and accepted a command in the Irish service under the parliament. He obtained the command in chief of all the parliamentary forces in the north of Ireland, where he did signal services, until he was called to account for a treaty made with the Irish rebels; a circumstance which was only obliterated by his future good fortune. He served in Scotland under Oliver Cromwell with such success, that he was left there as commander in chief; and he was one of the commissioners for uniting that kingdom with the new-erected commonwealth. He served at sea also against the Dutch; and was treated so kindly on his return, that Oliver is said to have grown jealous of him. He was, however, again sent to Scotland as commander in chief, and continued there five years: when he dissembled so well, and improved circumstances so dextrously, that he aided the desires of a wearied people, and restored the king without any disturbance; for which he was immediately rewarded both with honours and profit: (See Britain, n° 194, &c.)—He was created duke of Albemarle, with a grant of 7000 l. *per annum* estate, beside other emoluments; and enjoyed the confidence of his master without forfeiting that of the people. After his death in 1670, there was published a treatise composed by him while he remained prisoner in the Tower, intitled, "Observations on Military and Political Affairs," a small folio.

Monk-Fish. See Squalus.

Monks-Head, or *Wolf's bane*. See Aconitum.

MONKEY, in zoology. See Ape and Simia.

MONMOUTH (James, duke of), son to Charles II. by Mrs Lucy Walters, was born at Rotterdam in 1649. Upon the Restoration, he was called over to England, where the king received him with all imaginable joy, created him earl of Orkney (which was changed into that of Monmouth), and he took his seat in the house of peers in the ensuing session of parliament. He married Anne, the heiress of Francis earl of Buccleugh; and hence it came to pass that he had also the title of *Buccleugh*, and took the surname of *Scot*, according to the custom of Scotland. In 1668 his father made him captain of his life-guard of horse; and in 1672 he attended the French king in the Netherlands, and gave proofs of bravery and conduct. In 1673 the king of France made him lieutenant-general of his army, with which he came before Maestricht, and behaved himself with incredible gallantry, being the first who entered it himself. He returned to England, was received with all possible respect, and was received chancellor of the university of Cambridge. After this he went to assist the prince of Orange to raise the siege of Mons, and did not a little contribute towards it. He returned to England; and was sent, in quality of his father's general, to quell an insurrection in Scotland, which he effected: but soon after he fell into disgrace; for, being a Protestant, he was deluded into ambitious schemes, upon the hopes of the exclusion of the duke of York: he conspired against his father and the duke: and when the latter came to the throne by the title of *James II.* he openly appeared in arms, encouraged by the Protestant army; but coming to a decisive battle before he had sufficient forces to oppose the royal army, he was defeated, taken soon after concealed in a ditch, tried for high treason, condemned, and beheaded in 1685, aged 36. See Britain, n° 242. 249—265.

Monmouth, the capital of the county of Monmouthshire in England, 129 miles from London.—It has its name from its situation at the conflux of the Monow or Mynwy, and the Wye, over each of which it has a bridge, and a third over the Frothy.—Here was a castle in William the Conqueror's time, which Henry III. took from John Baron of Monmouth. It afterwards came to the house of Lancaster, who bestowed many privileges upon the town. Here Henry V. surnamed *of Monmouth*, was born. The famous historian Geoffrey was also born at this place. Formerly it gave the title of *earl* to the family of Carey, and of *duke* to king Charles the Second's eldest natural son; but now of *earl* to the Mordaunts, who are also earls of Peterborough. It is a populous and well built place, and carries on a con-

considerable trade with Bristol by means of the Wye. It has a weekly market, and three fairs.

Monmouthshire, a county of England; anciently reckoned a part of Wales, but in Charles the Second's time taken into the Oxford circuit, and made an English county. It is bounded on the north by Herefordshire, on the east by Glocestershire, on the south by the river Severn, and on the west by the Welch counties of Brecknock and Glamorgan. Its extent from north to south is about 30 miles, from east to west 26, and in circumference 110. It is subdivided into six hundreds; and contains seven market-towns, 127 parishes, about 6494 houses, 38,900 inhabitants; but sends only three members to parliament, that is, one for Monmouth, and two for the county. The air is temperate and healthy; and the soil fruitful, though mountainous and woody. The hills feed sheep, goats, and horned cattle; and the valleys produce plenty of grass and corn. This county is extremely well watered by several fine rivers; for, besides the Wye, which parts it from Glocestershire, the Mynow, which runs between it and Herefordshire, and the Rumney, which divides it from Glamorganshire, it has, peculiar to itself, the Usk, which enters this county a little above Abergavenny, runs mostly southward, and falls into the Severn by the mouth of the Ebwith; which last river runs from north to south, in the western side of the county. All these rivers, especially the Wye and Usk, abound with fish, particularly salmon and trout.

MONNOYE (Bernard de la), born at Dijon in 1641, was a man of fine parts and great learning. He was admirably formed for poetry; and used to win the first prizes instituted by the members of the French academy, till he discontinued to write for them (it is said) at the solicitation of the academy; a circumstance which, if true, would reflect higher honour on him than a thousand prizes. All his pieces are in a most exquisite taste; and he was no less skilful in Latin poetry than in the French. Menage and Bayle have both bestowed the highest encomiums on his Latin poetry. His Greek poems are likewise looked upon as very good; and so are his Italian, which are written with great spirit. But poetry was not La Monnoye's only province: to a perfect skill in poetry, he joined a very accurate and extensive knowledge of the languages. He had great skill in criticism; and no man applied himself with greater assiduity to the study of history, ancient and modern. He was perfectly acquainted with all the scarce books that had any thing curious in them; very well versed in the history of the learned; and what completes all, is the wonderful clearness with which he possessed these various kinds of knowledge. He wrote Remarks on the Menagiana; in the last edition of which, in 4 vols 12mo, printed in 1715, are included several pieces of his poetry, and a curious dissertation on the famous book *De tribus Impostoribus*. His Dissertation on *Pomponius Lætus*, at least an extract of it, is inserted in the new edition of Baillet's *Jugemens des sçavans*, published in 1722, with a great number of remarks and corrections by La Monnoye. He also embellished the Anti-Baillet of Menage with a multitude of corrections and notes. It would employ several pages to enumerate the various services this ingenious and learned man did to the republic of letters; as well by enriching it with productions of his own, as by the assistance which he communicated very freely upon all occasions to the learned of his times. Thus, among others, he favoured Bayle with a great number of curious particulars for his Dictionary, and was highly applauded by him on that account. He died at Paris, October 15th 1728, in his 88th year. —Mr de Sallinger published at the Hague A Collection of Poems by La Monnoye, with his elogium, from whence many of the above particulars are taken. He also left behind him a Collection of Letters, mostly critical; several curious Dissertations; 300 Select Epigrams from Martial, and other poets ancient and modern, in French verse; several other works in prose and verse, in French, Latin, and Greek, all ready for the press.

MONNOYER (John Baptist), "one of the greatest masters (according to Mr Walpole) that has appeared for painting flowers. They are not so exquisitely finished as Van Huysum's, but his colouring and composition are in a bolder style." He was born at Lisle in 1635; and educated at Antwerp as a painter of history, which he soon changed for flowers. Going to Paris in 1663, he was received into the academy with applause; and employed at Versailles, Trianon, Marly, and Meudon; and painted in the hotel de Bretonvilliers at Paris, and other houses. The duke of Montague brought him to England; where much of his hand is to be seen, at Montague-house, Hampton-court, the duke of St Alban's at Windsor, Kensington, Lord Carlisle's, Burlington-house, &c. But his most curious work is said to be a looking-glass at Kensington palace, which he adorned with flowers for Queen Mary, who held him in such high esteem, that she honoured him with her presence nearly the whole time he was busied in the performance.—Baptist passed and repassed several times between France and England; but having married his daughter to a French painter who was suffered to alter and touch upon his pictures, Baptist was offended and returned to France no more. He died in Pall-mall in 1699. —His son Antony, called *young Baptist*, painted in his father's manner, and had merit.

MONOCEROS, unicorn, in astronomy, a southern constellation formed by Hevelius, containing in his catalogue 19 stars, and in the Britannic Catalogue 31.

MONOCEROS, in zoology. See Monodon.

MONOCHORD; an instrument by which we are enabled to try the several proportions of musical sounds and intervals, as well in the natural as in tempered scales. Originally it had, as its name implies, only one string; but it is better constructed with two, as we have by means of this additional string an opportunity of judging of the harmony of two tempered notes in every possible variety of temperament (see Temperament and Tuning). It consists of a brass rule placed upon a sound-board, and accurately divided into different scales according to the purposes for which it is chiefly intended. Above this rule the strings are to be stretched over two fixed bridges, between which there is a moveable fret, so contrived as to divide at pleasure one of the strings into the same proportional parts as are engraved upon the scales beneath. The figure of the instrument, the manner of

Mono-chord.

ſtriking the ſtrings ſo as to produce the ſound, as likewiſe the conſtruction of the moveable bridge, may be varied at pleaſure according to the wiſh and ingenuity of the artiſt: But with the aſſiſtance of ſuch an inſtrument accurately conſtructed, any perſon with a good ear may be enabled to tune a keyed inſtrument with ſufficient preciſion to anſwer every practical purpoſe.

The following table contains the chief ſcales that have hitherto been computed. In column 1ſt is given the natural ſcale, or ſcale of perfect intervals. The ſecond column contains a new tempered ſcale, which ſeems better adapted than any other to keyed inſtruments, when chiefly deſigned for leſſon-playing, or playing without accompanyments. The third is a ſcale propoſed by Mr Emerſon in his Mechanics, and ſince recommended by Mr Jones in his Phyſiological Diſquiſitions, and by Mr Cavallo in the Philoſophical Tranſactions for 1788. The fourth and fifth exhibit the ſyſtems of mean tones, and of equal harmony, calculated by Dr Smith for inſtruments of a more perfect conſtruction than thoſe now in uſe.

Note.	Natural Scale.	Temper-ed Scale.	Emerſon, Jones, &c.	Mean Tones.	Equal harmony
C		1000			
C ※	937.5	952.9	943.8	957	959.3
D♭				934.5	933
D	888.9	893.3	890.9	894.4	895
D ※	833.3	837.5	840.8	856	858.6
E♭				836	835
E	800	798	793.7*	800	801
F♭				781	779
E ※				765.6	768.5
F	750	748.1	749.1	747.6	747.4
F ※	711.1	712.9	707.1	715.5	717
G♭				698.7	697.3
G	666.7	668.3	667.4	668.7	669
G ※	625	632	629.9	640	641.7
A♭				625	624
A	600	597	594.6	598	598.7
A ※	562.5	559.7	561.2	572.4	574.4
B♭				559	558.6
B	533.3	533.3	529.7*	535	536
C♭				522.4	521
B ※				512	514
C	500	500	500	500	500

N. B. Mr Jones propoſes to have the two numbers which are denoted by ſtars reſpectively altered to the numbers 796 and 531.

The method of tuning any inſtrument by means of the monochord is as follows: Firſt, you muſt tune the C of the monochord to the concert pitch by means of a tuning-fork; next, you are to put the middle C of your inſtrument in perfect uniſon with the C of the monochord: Then move the ſliding fret to the next diviſion on the ſcale, and proceed in the ſame manner with all the ſeveral notes and half notes within the compaſs of an octave. When this is done with accuracy, the other keys are all to be tuned, by comparing them with the octave which is already tempered. [The monochord is here ſuppoſed to be made to the pitch of C; but this may be varied at the will of the conſtructor.]

The curious reader who may wiſh for further information reſpecting the conſtruction and uſe of monochords, will be highly gratified in peruſing the appendix of Mr Atwood's Treatiſe on Rectilinear Motion, and Mr Jones's ingenious and entertaining obſervations on the ſcale of muſic, monochord, &c. in his Phyſiological Diſquiſitions.

MONOCHORD is alſo uſed for any muſical inſtrument that conſiſts of only one ſtring or chord; in this ſenſe the trumpet marine may properly be called a *monochord*.

MONOCULUS, in zoology; the name of a genus of inſects of the order of *aptera*, in the Linnæan ſyſtem. Its body is ſhort, of a roundiſh figure, and covered with a firm cruſtaceous ſkin; the fore-legs are ramoſe, and ſerve for leaping and ſwimming; it has but one eye, which is large, and compoſed of three ſmaller ones.

Of this genus, many of which have been reckoned among the microſcopic animals, authors enumerate a great number of ſpecies. The figure in Plate CCCXV. repreſents the quadricornis, or four-horned monoculus, a very ſmall ſpecies about half a line in length, and of an aſhen grey colour. From the head ariſe four antennæ, two forwards and two backwards; all four furniſhed with a few hairs, which give them the figure of a branch. Between the antennæ, on the fore part of the head, is ſituated a ſingle eye. From the head to the tail the body goes down, decreaſing in ſhape like a pear; and is compoſed of ſeven or eight rings, which grow continually more ſtraitened. The tail is long, divided into two; each diviſion giving riſe outwardly to three or four briſtly hairs. The animal carries its eggs on the two ſides of its tail in the form of two yellowiſh parcels filled with ſmall grains, and which taken together, nearly equal the inſect in bigneſs. This minute inſect is found in ſtanding pools. A number of them being kept in a bottle of water, ſome will be ſeen loaded with their eggs, and after a while depoſiting the two parcels, either jointly or ſeparately.

The name *monoculus* has been given to this genus, as conſiſting of individuals which apparently have but one eye: and from the manner in which they proceed forward in the water by leaping, they have alſo been called *water-fleas*. The branching antennæ ſerve them inſtead of oars, the legs being ſeldom uſed for ſwimming. " The tail, forked in ſome ſpecies, in others ſimple, ſerves them for a rudder. Their colour varies from white to green, and to red, more or leſs deep, doubtleſs in a ratio to the fragments of the vegetables on which they feed. The red tincture they ſometimes give to the water, has made ſome ignorant men think that the water had turned to blood. Too weak to be carnivorous, they on the contrary fall a prey to other aquatic inſects, even to polypi. Their body, compact and hard, is ſo tranſparent that in ſome the eggs with which the abdomen is filled are diſcernible. The water-parrot and the ſhell-monoculus, are remarkable. This latter is provided with a bivalvular ſhell, within which he ſhuts himſelf

Barbut's *[Ge]nera of [In]ſects*, p. 360.

odon. himfelf up, if drawn out of the water. The fhell opens underneath, the infect puts forth its antennæ, by means of which it fwims very expeditioufly in various directions, feeking a folid body to adhere to, and then it is it ufes its feet in walking, by ftretching them out through the aperture of its fhell.

"I preferved a pair of thefe infects (fays our author), laft year, in a fmall glafs tumbler, the one male the other female, having a bag filled with eggs affixed on each fide the abdomen. In the fpace of 14 days the increafe was aftonifhing: it would have been impoffible to have taken a fingle drop of water out of the glafs without taking with it either the larva or a young monoculus. I again repeated the experiment by felecting another pair; and at the expiration of the laft 14 days my furprife was increafed beyond meafure. The contents of the glafs appeared a mafs of quick-moving, animated matter; and being diverfified by colours of red, green, afh-colour, white, &c. afforded, with the affiftance of the magnifier, confiderable entertainment."

MONODON, in ichthyology, a genus of fifhes belonging to the order of *cete;* the characters of which are: There are too very long, ftraight, and fpirally twifted teeth, which ftick out from the upper jaw; and the fpiracle, or breathing hole, is fituated on the anterior part of the fkull. There is but one fpecies, the monoceros, or horned narwhal, which fometimes grows to 25 feet in length, exclufive of the horn; but the ufual fize is from 16 to 20. It is particularly noted for its horn or horns, as they are called; but which are real teeth. Of thefe there are always two in young animals; though the old ones have generally but one, fometimes none. From the circumftance of only one tooth being ufually found, the animal has acquired the name of *Unicorn Fifh*, or *Sea Unicorn.* They inhabit the northern feas, from Norway to within the arctic circle: they are plentiful in Davis's ftraits and the north of Greenland; where the natives, for want of wood, make rafters of the teeth. From the tooth or horn may be diftilled a very ftrong *fal volatile:* the fcrapings are efteemed *alexipharmic*, and were ufed of old in malignant fevers and againft the bites of ferpents. The ufe of it to the animal feems to be chiefly as a weapon of offence, and a very powerful one it appears to be: there are many inftances of its having been found in the bottoms of fhips which returned from the northern feas, probably owing to the animal's having miftaken the fhip for a whale, and attacked it with fuch fury as not to be able to get out the weapon from the wood. It may alfo ferve as an inftrument to loofen and difengage from the rocks or bottom of the fea the fea plants on which it feeds. Thefe fifhes fwim fwiftly, and can only be ftruck when numbers happen to be found together, and obftruct their own courfe with their teeth. Their fkin is white, with black fpots on the back, and has a great quantity of blubber underneath.

te XV.

The tooth of this animal was in old times impofed upon the world as the horn of an unicorn, and fold at a very high price. The heirs of the chancellor to Chriftian Frifius of Denmark, valued one at 8000 imperials. There is a magnificent throne made of this fpecies of ivory for the Danifh monarchs, which is ftill preferved in the caftle at Rofenberg. The price of this material was fuperior to gold.

Monody || Monophyfites.

MONODY, in ancient poetry, a mournful kind of fong, fung by a perfon all alone, to give vent to his grief. The word is derived from μονος "alone," and ᾳδω "I fing."

MONOECIA, from μονος *alone*, and οικια a *houfe;* the name of the 21ft clafs in Linnæus's fexual method. See BOTANY.

MONOGAMY, compounded of μονος *folus*, and γαμος "marriage," the ftate or condition of thofe who have only married once, or are reftrained to a fingle wife. See POLYGAMY.

MONOGLOSSUM (anc. geog.), a mart-town of the Hither India, fituated on the Sinus Canthi, into which the Indus empties itfelf. Said to be Mangalor on the coaft of Malabar. E. Long. 74°, N. Lat. 13°.

MONOGRAM, a character or cypher, compofed of one, two, or more letters interwoven; being a kind of abbreviation of a name, anciently ufed as a feal, badge, arms, &c.

MONOGYNIA, from μονος *alone*, and γυνη a *woman;* the name of the firft order or fubdivifion in the firft 13 claffes of Linnæus's fexual method; confifting of plants which, befides their agreement in their claffic character, generally derived from the number of their ftamina, have only one ftyle, or female organ.

MONOMOTAPA, a country of Africa, has the maritime kingdom of Sofala on the eaft, the river Del Spiritu Santo on the fouth, the mountains of Caffraria on the weft, and the river Cauma on the north, which parts it from Monoemugi. The air of this country is very temperate; the land fertile in paftures and all the neceffaries of life, being watered by feveral rivers. The inhabitants are rich in black cattle, which they value more than gold. They have a vaft number of elephants, as appears from the great quantity of ivory that is exported from hence. There are many gold-mines, and the rivers that run through their veins carry a great deal of gold-duft along with them. The inhabitants are lovers of war, which is the employment followed by all thofe who do not apply themfelves to commerce. This country is divided into feven provinces or petty kingdoms, vaffals to the king; viz. Monomotapa Proper, Quiteve, Manica, Inhambana, Inhemior, Sabia, and Sofala.

MONOPETALOUS, in botany, a term applied to flowers that have only one petal or flower-leaf.

MONOPHYSITES, (from μονος *folus*, and φυσις *natura*), a general name given to all thofe fectaries in the Levant who only own one nature in Jefus Chrift; and who maintain, that the divine and human nature of Chrift were fo united as to form only one nature, yet without any change, confufion, or mixture of the two natures.

The *monophyfites*, however, properly fo called, are the followers of Severus, a learned monk of Paleftine, who was created patriarch of Antioch in 513, and Petrus Fullenfis.

The monophyfites were encouraged by the emperor Anaftafius, but depreffed by Juftin and fucceeding emperors. However, this fect was reftored by Jacob Baradæus an obfcure monk, infomuch that when

when he died bishop of Edessa, A. D. 588, he left it in a most flourishing state in Syria, Mesopotamia, Armenia, Egypt, Nubia, Abyssinia, and other countries. The laborious efforts of Jacob were seconded in Egypt and the adjacent countries, by Theodosius bishop of Alexandria; and he became so famous that all the monophysites of the east considered him as their second parent and founder, and are to this day called *jacobites*, in honour of their new chief. The monophysites are divided into two sects or parties, the one African, the other Asiatic; at the head of the latter is the patriarch of Antioch, who resides for the most part in the monastery of St Ananias, near the city of Merdin: the former are under the jurisdiction of the patriarch of Alexandria, who generally resides at Grand Cairo, and are subdivided into Cophts and Abyssinians. From the 15th century downwards, all the patriarchs of the monophysites have taken the name of *Ignatius*, in order to show that they are the lineal successors of Ignatius, who was bishop of Antioch in the first century, and consequently the lawful patriarchs of Antioch. In the 17th century, a small body of the monophysites in Asia abandoned for some time the doctrine and institution of their ancestors, and embraced the communion of Rome: but the African monophysites, notwithstanding that poverty and ignorance which exposed them to the seductions of sophistry and gain, stood firm in their principles, and made an obstinate resistance to the promises, presents, and attempts employed by the papal missionaries to bring them under the Roman yoke: and in the 18th century, those of Asia and Africa have persisted in their refusal to enter into the communion of the Romish church, notwithstanding the earnest intreaties and alluring offers that have been made from time to time by the pope's legates, to conquer their inflexible constancy. The monophysites propagate their doctrine in Asia with zeal and assiduity, and have not long ago gained over to their communion a part of the Nestorians, who inhabit the maritime coasts of India.

MONOPOLY, one or more persons making themselves the sole masters of the whole of a commodity, manufacture, and the like, in order to make private advantage of it, by selling it again at a very advanced price. Or it is a licence or privilege allowed by the king for the sole buying and selling, making, working, or using any thing whatsoever.—Monopolies had been carried to an enormous height during the reign of Queen Elisabeth; and were heavily complained of by Sir Edward Coke, in the beginning of the reign of King James I.: but were in great measure remedied by statute 21 Jac. I. c. 3. which declares such monopolies to be contrary to law, and void; (except as to patents, not exceeding the grant of 14 years, to the authors of new inventions; and except also patents concerning printing, saltpetre, gunpowder, great ordnance, and shot); and monopolists are punished with the forfeiture of treble damages and double costs, to those whom they attempt to disturb; and if they procure any action, brought against them for these damages, to be stayed by any extrajudicial order, other than of the court wherein it is brought, they incur the penalties of *præmunire*. Combinations also among victuallers or artificers, to raise the price of provisions, or any commodities, or the rate of labour, are in many cases severely punished by particular statute; and, in general, by statute 2 & 3 Edward VI. c. 15. with the forfeiture of L. 10 or 20 days imprisonment, with an allowance of only bread and water for the first offence; L. 20 or the pillory for the second; and L. 40 for the third, or else the pillory, loss of one year, and perpetual infamy. In the same manner, by a constitution of the emperor Zeno, all monopolies and combinations to keep up the price of merchandise, provisions, or workmanship, were prohibited, upon pain of forfeiture of goods and perpetual banishment.

MONOSYLLABLE, in grammar, a word that consists only of one syllable, and is composed either of one or more letters pronounced at the same time. The too frequent use of monosyllables has a very bad effect in English poetry, as Mr Pope both intimates and exemplifies in the same verse, viz.

"And ten slow words oft creep in one dull line."

MONOTHELITES, (compounded of μονος single, and θελημα "will," of θελω *volo* "I will"), an ancient sect, which sprung out of the Eutychians; thus called, as only allowing of one will in Jesus Christ.

The opinion of the Monothelites had its rise in 630, and had the emperor Heraclius for an adherent: it was the same with that of the Acephalous Severians. They allowed of two wills in Christ, considered with regard to the two natures; but reduced them to one, by reason of the union of the two natures; thinking it absurd there should be two free wills in one and the same person. They were condemned by the sixth general council in 680, as being supposed to destroy the perfection of the humanity of Jesus Christ, depriving it of will and operation. Their sentiments were afterwards embraced by the Maronites.

MONOTONY, an uniformity of sound, or a fault in pronunciation, when a long series of words are delivered in one unvaried tone. See READING.

MONOTROPA, BIRD'S-NEST: A genus of the monogynia order, belonging to the monandria class of plants; and in the natural method ranking with those of which the order is doubtful. There is no calyx, but 10 petals; and of these the five exterior have a melliferous hollow at the base. The capsule is quinquevalved. In some of the flowers a fifth part of the number is excluded as in the *M. hippopithys*. There are two species; of which the only remarkable one is the hippopithys, a native of Britain and some of the more northerly kingdoms of Europe. It is about five inches high, having no other leaves than oval scales, and terminated with a nodding spike of flowers, which in the seeding state becomes erect: the whole plant is of a pale yellow colour, smelling like the primrose, or like beans in blossom. The country people in Sweden give the dried plant to cattle that have a cough.

MONREAL. See MONTREAL.

MONRO (Dr Alexander, senior), a most eminent physician and anatomist, was descended by his father from the family of Monro of Milton, which had large possessions in the county of Ross; and by his mother, from that of Forbes of Culloden.

His father John, youngest son of Sir Alexander Monro of Bearcrofts, was bred to physic and surgery, and

ro. and ſerved for ſome years as a ſurgeon in the army under King William in Flanders: but, for ſeveral ſucceſſive years, obtaining leave of abſence from the army in the winter, he during that ſeaſon reſided with his wife in London, where his ſon Alexander was born in the 1697. About three years thereafter, he quitted the army, and went to ſettle as a ſurgeon at Edinburgh; where his knowledge in his profeſſion, and engaging manners, ſoon introduced him into an extenſive practice.

The ſon ſhowed an early inclination to the ſtudy of phyſic; and the father, after giving him the beſt education that Edinburgh then afforded, ſent him ſucceſſively to London, Paris, and Leyden, to improve himſelf further in his profeſſion. At London, he attended the lectures of Meſſrs Hawkſbee and Whiſton on experimental philoſophy, and the anatomical demonſtrations of Mr Cheſelden. At Paris, he attended the hoſpitals, and the lectures which were read on the different branches of phyſic and ſurgery at that time. Towards the end of autumn 1718, he went to Leyden, and ſtudied under the great Boerhaave; by whom he was particularly eſteemed.

On his return to Edinburgh in autumn 1719, Meſſrs Drummond and Macgill, who were then conjunct nominal profeſſors and demonſtrators of anatomy to the ſurgeons company, having reſigned in his favour, his father prevailed on him to read ſome public lectures on anatomy, and to illuſtrate them by ſhowing the curious anatomical preparations which he had made and ſent home when abroad. He at the ſame time perſuaded Dr Alſton, then a young man, to give ſome public lectures on botany. Accordingly, in the beginning of the winter 1720, theſe two young profeſſors began to give regular courſes of lectures, the one on the materia medica and botany, the other on anatomy and ſurgery; which were the firſt regular courſes of lectures on any of the branches of medicine that had ever been read at Edinburgh, and may be looked upon as the opening of that medical ſchool which has ſince acquired ſuch great reputation all over Europe.

In ſummer 1721 and 1722, Dr Monro, by the perſuaſion of his father, read ſome lectures on chirugical ſubjects; particularly on wounds and tumors, which he never would publiſh, having wrote them in a hurry and before he had much experience; but inſerted from time to time the improvements he thought might be made in ſurgery, in the volumes of Medical Eſſays and Obſervations to be hereafter mentioned.

About the year 1720, his father communicated to the phyſicians and ſurgeons at Edinburgh, a plan, which he had long formed in his own mind, of having the different branches of phyſic and ſurgery regularly taught at Edinburgh; which was highly approved of by them, and by their intereſt regular profeſſorſhips of anatomy and medicine were inſtituted in the univerſity. His ſon, Dr Monro, was firſt made univerſity-profeſſor of anatomy; and two or three years afterwards, Drs Sinclair, Rutherford, Innes, and Plummer, were made profeſſors of medicine; the profeſſorſhip of materia medica and botany, which Dr Alſton then held, having been added to the univerſity many years before. Immediately after theſe gentlemen were elected profeſſors, they began to deliver regular courſes of lectures on the different branches of medicine, and they and their ſucceſſors have uniformly continued ſo to do every winter. Monro.

The plan for a medical education at Edinburgh was ſtill incomplete without an hoſpital, where ſtudents could ſee the practice of phyſic and ſurgery, as well as hear the lectures of the profeſſors. A ſcheme was therefore propoſed by Dr Monro's father, and others, particularly the members of the royal college of phyſicians and board of ſurgeons, for raiſing by ſubſcription a fund for building and ſupporting an hoſpital for the reception of diſeaſed poor; and our author publiſhed a pamphlet ſetting forth the advantages that would attend ſuch an inſtitution. In a ſhort time a conſiderable ſum of money was raiſed, a ſmall houſe was fitted up, and patients were admitted into it, and regularly attended by many of the phyſicians and ſurgeons in town. The fund for this charity increaſing very conſiderably, in a great meaſure from the activity and influence of that very worthy citizen and magiſtrate George Drummond, Eſq; the foundation was laid of the preſent large, commodious, and uſeful hoſpital, the *Royal Infirmary;* in the planning of which Dr Monro ſuggeſted many uſeful hints, and in particular the elegant room for chirurgical operations was deſigned and executed under his direction. Provoſt Drummond and he were nominated the building committee; and the fabric was entirely completed in a ſhort ſpace of time. It has ſince been ſo largely endowed, as to be capable of receiving a great number of diſeaſed poor, whoſe caſes the ſtudents of phyſic and ſurgery have an opportunity of ſeeing daily treated with the greateſt attention and care by phyſicians and ſurgeons eminent in their profeſſion; and a regiſter of the particulars of all the caſes which have been received into the houſe ſince its firſt opening has been kept, in books appropriated for that purpoſe, for the uſe of the ſtudents.

In order to make the hoſpital of ſtill further uſe to the ſtudents, Dr Monro frequently, while he continued profeſſor of anatomy, gave lectures on the chirurgical caſes; and the late judicious phyſician, Dr Rutherford profeſſor of the practice of phyſic, began, in the year 1748, to deliver clinical lectures, to be continued every winter, on the moſt remarkable caſes in the hoſpital.

Doctor Monro, though he was elected profeſſor of anatomy in the year 1721, was not received into the univerſity till the year 1725, when he was inducted along with that great mathematician the late Mr Colin Maclaurin, with whom he ever lived in the ſtricteſt friendſhip. From this time he regularly every winter gave a courſe of lectures on anatomy and ſurgery, from October to May, upon a moſt judicious and comprehenſive plan: A taſk in which he perſevered with the greateſt aſſiduity, and without the leaſt interruption, for near 40 years; and ſo great was the reputation he had acquired, that ſtudents flocked to him from the moſt diſtant corners of his majeſty's dominions.

In 1759, our profeſſor entirely relinquiſhed the buſineſs of the anatomical theatre to his ſon Dr Alexander, who had returned from abroad, and had aſſiſted him in the courſe of lectures the preceding year. But after this reſignation, he ſtill endeavoured to render his

Monro. labours uſeful to mankind, by reading clinical lectures at the hoſpital for the improvement of the ſtudents; of which Dr Duncan, who was one of his pupils, has given the following account. "There I had myſelf the happineſs of being a pupil, who profited by the judicious conduct of his practice, and was improved by the wiſdom and acuteneſs of his remarks. I have indeed to regret that I attended only the laſt courſe of lectures in which he had ever a ſhare, and at a time when he was ſubjected to a diſeaſe which proved at length fatal. Still, however, from what I ſaw and from what I heard, I can venture to aſſert, that it is hardly poſſibly to conceive a phyſician more attentive to practice, or a preceptor more anxious to communicate inſtructions. His humanity, in the former of theſe characters, led him to beſtow the moſt anxious care on his patients while they were alive; and his zeal in the latter induced him to make them the ſubject of uſeful leſſons when they happened to die.—In the different ſtations of phyſician, of lecturer, and of manager in the hoſpital, he took every meaſure for inquiring into the cauſes of diſeaſes by diſſection — He perſonally attended the opening of every body; and he not only dictated to the ſtudents an accurate report of the diſſection, but with nice diſcrimination contraſted the diſeaſed and ſound ſtate of every organ. Thus, in his own perſon, he afforded to the ſtudents a conſpicuous example of the advantages of early anatomical purſuits, as the happieſt foundation for a medical ſuperſtructure. His being at once engaged in two departments, the anatomical theatre and clinical chair, furniſhed him with opportunities both on the dead and living body, and placed him in the moſt favourable ſituation for the improvement of medicine; and from theſe opportunities he derived every poſſible advantage which they could afford."

His father, old Mr Monro, lived to an advanced age; and enjoyed the unſpeakable pleaſure of beholding a ſon, eſteemed and regarded by mankind, the principal actor in the execution of his favourite plan, the great object of his life, the founding a ſeminary of medical education in his native country: The ſon, who ſurvived him near 30 years, had the ſatisfaction to behold this ſeminary of medical education frequented yearly by 300 or 400 ſtudents, many of whom came from the moſt diſtant corners of his majeſty's dominions, and to ſee it arrive to a degree of reputation far beyond his moſt ſanguine hopes, being equalled by few, and inferior to none, in Europe.

Few men were members of more ſocieties than Dr Monro; ſtill fewer equally aſſiduous in their attendance of thoſe which in any way tended to promote public utility. He was a manager of many public charities; and not only a member of different medical ſocieties, but likewiſe of ſeveral others inſtituted for promoting literature, arts, ſciences, and manufactures, in Scotland, and was one of their moſt uſeful members.—While he was held in high eſtimation at home, he was equally eſteemed and reſpected abroad, and was elected member of the Royal Society of London, and an honorary member of the Royal Academy of Surgery at Paris.

He was not only very active in the line of his own profeſſion, but as a citizen and general member of the community; for, after he had reſigned the anatomical chair to his ſon, he executed with the ſtricteſt punctuality the duties of ſeveral engagements both of a civil and political nature: He was a director of the Bank of Scotland, a Juſtice of the Peace, a Commiſſioner of High-Roads, &c. At length, after a life ſpent in the moſt active induſtry, he became afflicted with a tedious and painful diſeaſe, which he bore with equal courage and reſignation till his death, which happened on July 10th 1767, in the 70th year of his age.

Of his works, the firſt in order is his Oſteology, which was written for the uſe of ſtudents, but is capable alſo of affording inſtruction to the oldeſt and moſt experienced practitioner; as, beſides a minute deſcription of the parts copied from nature, it every where abounds with new and important obſervations immediately applicable to practice. It has been tranſlated into many different languages; has paſſed through numerous editions; and has been reprinted in foreign countries in the moſt ſuperb manner, accompanied with elegant and maſterly engravings. His deſcription of the Lacteal Sac and Thoracic Duct contains the moſt accurate account of that important part of the body which has been yet publiſhed; and his Anatomy of the Nerves will tranſmit to poſterity an excellent example of accurate diſſection, faithful deſcription, and ingenious reaſoning. The ſix volumes of Medical Eſſays and Obſervations, publiſhed by a ſociety in Edinburgh, are univerſally known and eſteemed. To that ſociety he was appointed ſecretary; but, after the publication of the firſt volume, to which he had largely contributed, the members growing remiſs in their attendance, he became the ſole collector and publiſher of the work: To him we are therefore in a great meaſure indebted for thoſe numerous and important diſcoveries with which this publication has enriched every department of medical knowledge. In the two firſt volumes of the Phyſical and Literary Eſſays, publiſhed by the phyſical ſociety of Edinburgh, in which he had the rank of one of the preſidents, we find ſeveral papers written by him, which are not the leaſt ornaments of that collection. His account of the Succeſs of Inoculation in Scotland may be conſidered as his laſt publication: It demonſtrates his extenſive correſpondence and indefatigable induſtry, and has had great influence in promoting that ſalutary practice. Beſides theſe, he was alſo the author of ſeveral other elegant and maſterly productions, which were either never publiſhed, or were publiſhed without his knowledge and from incorrect copies. A collection of all his works, properly arranged, corrected, and illuſtrated with copperplates, has been publiſhed by Dr Alexander Monro, his ſon and ſucceſſor in the anatomical chair, in a ſplendid quarto volume, printed for Elliot, Edinburgh, 1781; to which is prefixed a life of the author, by another of his ſons, Dr Donald, phyſician in London. The obſervation of an excellent judge, the illuſtrious Haller, concerning our author's Medical Eſſays and Obſervations, which now form a part of this collection, may with no leſs juſtice be applied to the whole: It is a "book which ought to be in the poſſeſſion of every medical practitioner."

MONS, an ancient, large, handſome, rich, and very ſtrong city of the Auſtrian Netherlands, in Hainault,

nault. There is a chapter, confifting of 30 ladies of diftinction, who have the liberty of leaving the community when they intend to marry. They have feveral manufactures, and a good trade. It was taken by the allies in 1709, and by the French in July 1746; but rendered back by the treaty of Aix-la-Chapelle, after the fortifications were demolifhed. It ftands partly on a hill, and partly on a plain in a marfhy foil, on the rivers Haine and Trouilli, by which the country about it may be overflowed at pleafure. It has been lately taken by the armies of the French Republic. E. Long. 3. 39. N. Lat. 50. 25.

MONS *Sacer*, (anc. geog.), a mountain of the Sabines beyond the Anio, to the eaft of Rome; whither the common people retired once and again to avoid the tyranny of the patricians. From this fecession, and the altar of *Jupiter Terribilis* erected there, the mountain took its name.

MONSEIGNEUR, in the plural *Meffeigneurs*, a title of honour and refpect ufed by the French in writing to perfons of fuperior rank or quality, before the late abolition of all ranks.

Dukes, peers, archbifhops, bifhops, and prefidents *à la mortier*, were complimented with the title of *Monfeigneur*. In the petitions prefented to the fovereign courts, they ufed the term *Meffeigneurs*.

MONSEIGNEUR, abfolutely ufed, was a title reftrained to the dauphin of France. This cuftom was unknown till the time of Louis XIV. before which the dauphin was ftyled *Monfieur le Dauphin*.

MONSIEUR, in the plural *Meffieurs*, a term or title of civility, ufed by the French in fpeaking to their equals, or thofe a little below them, anfwering to *Mr* or *Sir* among the Englifh.

MONSIEUR, abfolutely ufed, was a title or quality appropriated to the fecond fon of France, or the king's brother. The king was alfo called *Monfieur*, but that only by the children of France.

MONSON (Sir William), a brave Englifh admiral, third fon of Sir John Monfon of South Carlton in Lincolnfhire, was born in 1569. He was employed in many expeditions againft the Spaniards in Queen Elizabeth's time, and was highly honoured; the queen knighted him for his fervices in the earl of Effex's expedition to Cadiz, where he affifted much by his wife and moderate counfel to the earl. Military men were no favourites with James I. therefore, on the death of the queen, he received no recompence or pay beyond the ordinary fervice in which he was engaged: neverthelefs, as admiral of the narrow feas, he fupported the honour of the Britifh flag againft the infant infolence of the Dutch ftates, of which he frequently complains in his Navy Tracts; and protected our trade againft the encroachments of France. He had the misfortune to fall into difgrace by his vigilance, and was imprifoned in the Tower through the refentment of fome powerful courtiers; yet he was difcharged, and wrote a vindication of his own conduct, intituled, "Concerning the infolencies of the Dutch, and a Juftification of Sir William Monfon." He fpent his latter days in peace and privacy, which he employed in digefting his Navy Tracts, and died in 1643.—Part of thefe tracts were printed in 1682; and they were afterwards all included in Churchill's Collection of Voyages.

MONSONIA, in botany: A genus of the dodecandria order, belonging to the polyadelphia clafs of plants. The calyx is pentaphyllous; the corolla pentapetalous and irregular; the ftamina are 15 in number, and coalited into five filaments; the ftyle bifid; the capfule pentacoccous.

MONSOON, a regular or periodical wind, in the Eaft Indies, blowing conftantly the fame way, during fix months of the year, and the contrary way the remaining fix.

In the Indian ocean, the winds are partly general, and blow all the year round the fame way, as in the Ethiopic ocean; and partly periodical, *i. e.* half the year blow one way, and the other half near on the oppofite points: and thofe points and times of fhifting differ in different parts of this ocean. Thefe latter are what we call *monfoons*.

The fhifting of thefe monfoons is not all at once; and in fome places the time of the change is attended with calms, in others with variable winds, and particularly thofe of China, at ceafing to be wefterly, are very fubject to be tempeftuous; and fuch is their violence, that they feem to be of the nature of the Weft India hurricanes, and render the navigation of thofe feas very unfafe at that time of the year. Thefe tempefts the feamen call the *breaking up of the monfoons*.

Monfoons, then, are a fpecies of what we otherwife call *trade-winds*. They take the denomination *monfoon* from an ancient pilot, who firft croffed the Indian fea by means hereof. Though others derive the name from a Portuguefe word, fignifying motion or change of wind, and fea.

Lucretius and Apollonius make mention of annual winds which arife every year, *etefia flabria*, which feem to be the fame with what in the Eaft Indies we now call *monfoons*. For the phyfical caufe of thefe winds, fee WIND.

MONSTER; a birth or production of a living being, degenerating from the proper and ufual difpofition of parts in the fpecies to which it belongs: As, when there are too many members, or too few; or fome of them are extravagantly out of proportion, either on the fide of defect or excefs. The word comes from the Latin *monftrum*, of *monftrando*, "fhowing." Whence alfo the box wherein relics were anciently kept to be fhown, was called *monftrum*. Dugdale mentions an inventory of the church of York with this article, *Item unum monftrum cum offibus fancti Petri in Beryl, & crucifixo in fummitate*.

Ariftotle defines a monfter to be a defect of nature, when, acting towards fome end, it cannot attend to it, from fome of its principles being corrupted.

Monfters do not propagate their kind; for which reafon fome rank *mules* among the number of monfters, as alfo *hermaphrodites*.

Females which bring forth twins, are found moft liable to produce monfters. The reafon, probably, is owing to this; that though the twins are covered with one common chorion, yet they have each their feparate amnios, which by their contiguity may chance to grow together, and fo occafion a confufion or blending of the parts. Hence fo many double creatures.

F. Malebranche accounts for the production of monfters in the animal world in the following man-

Monster.

ner: "The Creator has eſtabliſhed ſuch a communication between the ſeveral parts of his creation, that we are not only naturally led to imitate one another, *i. e.* have a diſpoſition to do the ſame things and aſſume the ſame manners with thoſe with whom we converſe; but alſo have certain natural diſpoſitions which incline us to compaſſion as well as imitation. Theſe things moſt men feel, and are ſenſible of; and therefore need not be proved. The animal ſpirits, then, are not only naturally carried into the reſpective parts of the body to perform the ſame actions and the ſame motions which we ſee others do, but alſo to receive in ſome manner their wounds, and take part in their ſufferings.

"Experience tells us, that when we look attentively on any perſon ſeverely beaten, or that hath a large wound, ulcer, or the like, the ſpirits immediately flow into thoſe parts of our body which anſwer to thoſe we ſee ſuffer in the other; unleſs their courſe be ſtopped from ſome other principle. This flux of ſpirits is very ſenſible in perſons of a delicate conſtitution, who frequently ſhudder, and find a kind of trembling in the body on theſe occaſions; and this ſympathy in bodies produces compaſſion in the mind

"Now it muſt be obſerved, that the view of a wound, &c. wounds the perſon who views it the more ſtrongly and ſenſibly, as the perſon is more weak and delicate; the ſpirits making a ſtronger impreſſion on the fibres of a delicate body than in thoſe of a robuſt one. Thus ſtrong, vigorous men, &c. ſee an execution without much concern, while women, &c. are ſtruck with pity and horror. As to children ſtill in their mother's womb, the fibres of their fleſh being incomparably finer than thoſe in women, the courſe of the animal ſpirits muſt neceſſarily produce much greater alterations.

"Theſe things being laid down, monſters are eaſily accounted for. Suppoſe, *v. gr.* a child born a fool, and with all its legs and arms broke in the ſame manner as thoſe of criminals in ſome countries are; which caſe we chooſe to inſtance in, becauſe we are told from Paris that ſuch a monſter was actually born there, and lived in one of their hoſpitals 20 years: the cauſe of this accident, according to the principles laid down, was, that the mother ſeeing a criminal executed, every ſtroke given to the poor man, ſtruck forcibly the imagination of the woman; and, by a kind of counterſtroke, the tender and delicate brain of the child.—Now, though the fibres of the woman's brain were ſtrangely ſhaken by the violent flux of animal-ſpirits on this occaſion, yet they had ſtrength and conſiſtence enough to prevent an entire diſorder; whereas the fibres of the child's brain being unable to bear the ſhock of thoſe ſpirits, were quite ruined, and the ravage was great enough to deprive him of reaſon all his lifetime.

"Again, the view of the execution frighting the woman, the violent courſe of the animal ſpirits was directed forcibly from the brain to all thoſe parts of the body correſponding to the ſuffering parts of the criminal; and the ſame thing muſt happen in the child. But in regard the bones of the mother were ſtrong enough to reſiſt the impulſe of thoſe ſpirits, they were not damaged: and yet the rapid courſe of theſe ſpirits could eaſily overpower and break the tender and delicate fibres of the bones of the child; the bones being the laſt parts of the body that are formed, and having a very ſlender conſiſtence while the child is yet in the womb."

To which it may be here added, that had the mother determined the courſe of theſe ſpirits towards ſome other part of her body, by tickling or ſcratching herſelf vehemently, the child would not in all probability have had its bones broken; but the part anſwering that to which the motion of the ſpirits was determined, would have been the ſufferer. Hence appears the reaſon why women in the time of geſtation, ſeeing perſons, &c. marked in ſuch a manner in the face, impreſs the ſame mark on the ſame parts of the child: and why, upon rubbing ſome hidden part of the body when ſtartled at the ſight of any thing or agitated with any extraordinary paſſion, the mark or impreſſion is fixed on that hidden part rather than on the face of the child. F om the principles here laid down, may moſt, if not all, the phenomena of monſters be eaſily accounted for.

Various other theories have been formed by different philoſophers and phyſiologiſts. But after all, it muſt be confeſſed, that we ſeem as yet to be very little acquainted with Nature in her ſports and errors. For each organiſed being there appears to exiſt a primitive germ or model of the different ſpecies drawn by the Creator, determined by forms and ſexes, and realiſed in the individuals of both ſexes, which muſt unite in order to their reproduction. From this model nature never departs, unleſs when compelled by circumſtances which derange the primitive organization common to the ſpecies, and produce what we call *monſters*.

With reſpect to ſtructure, we have already remarked, that monſters are of various kinds. Some have an exceſs or defect in certain parts; ſuch as thoſe which are called *acephalous*, or who want the head; thoſe which have two heads, two arms, two legs, and one body, or which have two bodies and one head, or which have three legs; and thoſe which want the arms or the legs. Others err through an extraordinary and deformed conformation, through an unnatural union of certain parts or viſcera, through a great derangement in one or more of their members, and through the extraordinary place which theſe often occupy in conſequence of this derangement or tranſpoſition. The monſter deſcribed by Dr Eller of the academy of Berlin was of this kind. It was a fœtus of nine months, 28 inches long, with an enormous head and frightful countenance; and in the middle of a broad and vaſt forehead it had a reddiſh eye, without either eyebrows or eyelids, and ſunk deep into a ſquare hole. Immediately below this eye was an excreſcence which ſtrongly reſembled a penis with a glans, a prepuce, and an urethra: the part covered with hair was likewiſe below the nape of the neck. In other monſters we meet with the unnatural union of ſome parts, which, from their deſtination and functions, ought always to be ſeparate; and the ſeparation of other parts, which, for the ſame reaſons, ought conſtantly to be united. The reader may ſee the different ways in which the formation of monſters takes place in four memoirs by M. Lemery, inſerted in *L'Hiſtoire de l'Academie des Sciences* 1738 and 1739. M. du Verney has likewiſe publiſhed a Memoir on the ſame ſubject.

In the volume published by the Academy of Sciences in 1724, mention is made by M. Geoffroy of a monster born in Barrois 1722. This monstrous production consisted of two children without the inferior extremities, joined together by a common navel: each of them had a nurse, sucked, and eat pap; and the one sucked while the other slept. The reader may likewise consult the second part of Winslow's Memoirs on Monsters, inserted in the volume published by the Academy of Sciences in 1734, where he will find the history of two very extraordinary twin monsters, who evidenced during their life a great difference in their moral and physical qualities. We are obliged simply to refer to those Memoirs, as they are too long for abridgement.

It is observed by Haller, that in some monsters the natural structure is changed by some shock or passion: in others the structure, independent of any accident, is originally monstrous; such as when all the members are reversed from left to right, when the person has six fingers, and in many other instances. M. de Maupertuis mentions, that there is at Berlin a family who have had six fingers on each hand for several generations. M. de Riville saw an instance of this at Malta, of which he has given a description. M. Renou, surgeon at Pommeraye in Anjou, has published an account of some families with six fingers, which are to be found in several parishes of the Lower Anjou, and which have existed there from time immemorial. This deformity is perpetuated in these families even when they intermarry with persons who are free from it. Whether the propagation of these supernumerary organs, which are not only useless but inconvenient and even disagreeable, be owing to the father or mother, their children of both sexes are subject to it indiscriminately. A father or mother with six fingers frequently have a part, and sometimes the whole, of their children, free from this deformity; but it again makes its appearance, and in a very great degree, in the third generation. From this it appears, that this fault in the conformation is hereditary. M. Reaumur has likewise published the history of a family in the island of Malta, the children of which are born with six fingers and six toes. But it deserves to be inquired, Whether these supernumerary fingers are real fingers? The reader may here consult the *Journal de Physique* for November 1774, p. 372. This variety of *sexdigitary* hands and feet is not comprehended in the *Recherches sur quelques conformations monstrueuses des doigts dans l'homme*, which is inserted in the Memoirs of the Academy of Sciences for 1771. In the *Journal de Physique* for August 1776, we find a description of a double uterus and vagina observed in a woman who died in childbed, by Dr Purcell of Dublin: and in that for June 1788, we have an account of a man with seven fingers on each hand, by Baron Dietrich.

Several monstrous productions are to be seen in the cabinet at Chantilly. 1. Two calves joined together in the body, with each a separate head and neck, and four legs in whole. 2. Two calves united only by the pelvis, with only one anus and one tail: the whole is supported by six legs, four before and two behind. 3. A lamb with six legs, four of which are behind. 4. The skeleton of a ram, which has likewise six legs. 5. A hermaphrodite deer. 6. The head of a foal, which has only one eye in the middle of the forehead. 7. Some leverets with six and eight legs. 8. A puppy, the lips of which are divided fourfold. 9. Some fœtuses of a hog which have a kind of tube upon their forehead one or two inches long; and another, the hinder part of which is double in every thing. 10. Two double human fœtuses joined by the belly, with four arms and three legs. 11. A young chicken with two bodies and one head. 12. A pigeon and a duck, each with two bills. 13. A duck with two heads. 14. A pigeon with four feet. 15. A capon with three feet; the third being fixed to the anus. 16. Two heads of a calf joined together, each of them with two ears: these two heads were both fixed to one neck. 17. In the *Menagerie* at Chantilly there was formerly to be seen a cow with five feet, the fifth of which was connected with the dug. 18. A rabbit without ears. 19. Two cats, each having two heads. 20. Two leverets newly brought forth, well shaped in the body and legs, but connected together by means of only one head. 21. Several eggs, in the figure of which there occur some monstrous appearances and extraordinary deformities, sufficient to show that they are contrary to the established form of nature.

Everhard Hume, Esq; F. R. S. some time ago presented to John Hunter, Esq; F. R. S. the *double skull* of a child, born at Calcutta in May 1783 of poor parents aged 30 and 35, and which lived to be nearly two years old. The body of this child was naturally formed: but the head had the phenomenon of appearing double; another head of the same size, and almost equally perfect, being attached to its upper part. In this extraneous and preternatural head no pulsation could be felt in the arteries of the temples, but the superficial veins were very evident; one of the eyes had been hurt by the fire, upon which the midwife, in her first alarm, threw the child: the other moved readily; but the iris was not affected by the approach of any thing to it. The external ears of this head were very imperfect; the tongue adhered to the lower jaw, except for about half an inch at the lip, which was loose; the jaw was capable of motion, but there were no teeth. The child was shown about the streets of Calcutta for a curiosity; but was rendered unhealthy by confinement, and died at last of a bite of the *cobra de capello*. It was dug up by the East India Company's agent for salt at Tumlock, and the skull is now in the museum of Mr Hunter.

Among the monstrous productions of the animal kingdom, we may rank those individuals which ought only to possess one sex, but in which we observe the union or the appearance of two. See the articles ANDROGYNES and HERMAPHRODITE.

M. Fabri arranges mutilations of the members, distortions, gibbosities, tumors, divisions of the lips or of the palate, compressions of the cranium, and many other deformities of this kind, in the class of *morbific* monstruosities. In that which he calls *connatural (connaturelle)* monstruosities, are placed the plurality, transposition, and insertion of the parts. To explain these facts, a great many writers have had recourse to the effect of the imagination of pregnant women.—The causes of the first class of monstruosities are discussed by M. Fabri, who observes, that some of them are *internal* with regard to the mother, and others *external*.

Monster. *ternal.* By an *internal cause*, he here means all those depravations or morbific principles which can affect the fluids, and which vitiate the form and structure of the solids; in particular the uterus, in which such depravations have often been found to occur. To these he adds violent affections of the mind, spasmodic contractions, hysteric convulsions, and the many inconveniences of this kind to which women are extremely subject. External causes comprehend every thing which can act externally upon the fœtus contained in the uterus, such as the pressure of the clothes; and in short every thing which prevents the free dilatation of the belly in women who are pregnant, violent motions, falls, blows, and all accidents of this kind. These external causes, and especially the first, compress the fœtus in the womb, and oblige it to remain in a very confined situation. This, according to the observation of Hippocrates, produces those embryos which are born with some entire part wounded. M. Fabri maintains, that all deformities of the fœtus proceed from mechanical and accidental causes.

The name of *monsters* is likewise given to animals enormous for bulk; such as the elephant among terrestrial quadrupeds, and the shark and the whale among sea animals; to other animals remarkable for fierceness and cruelty; and to animals of an extraordinary species, which, we are told, arises from the copulation of one animal with another of a different genus. According to the report of travellers, Africa abounds with monsters of this kind; and accounts of the East are full of descriptions of sea monsters, which, however, are seldom to be seen, such as *sea men*, *mermaids*, &c.

Monsters are more common and more extraordinary in the vegetable than in the animal kingdom, because the different juices are more easily deranged and confounded together. Leaves are often seen, from the internal part of which other leaves spring forth; and it is not uncommon to see flowers of the ranunculus, from the middle of which issues a stalk bearing another flower. M. Bonnet informs us, that in certain warm and rainy years he has frequently met with monsters of this kind in rose-trees. This observer saw a rose, from the centre of which issued a square stalk of a whitish colour, tender, and without prickles, which at its top bore two flower-buds opposite to each other, and totally destitute of a calyx; a little above the buds issued a petal of a very irregular shape. Upon the prickly stalk which supported the rose, a leaf was observed which had the shape of trefoil, together with a broad flat pedicle. In the Memoirs of the Academy of Sciences for 1707, p. 448, mention is made of a rose, from the centre of the leaves of which issued a rose-branch two or three inches long, and furnished with leaves. See the same Memoirs for 1749, p. 44, and for 1724, p. 20. In the Memoirs for 1775, a very singular instance is mentioned of a monstruosity observed by M. Duhamel, in an apple-tree ingrafted with clay. At the place of the insertion, there appeared a bud which produced a stalk and some leaves; the stalk and the pedicle of the leaves were of a pulpy substance, and had the most perfect resemblance both in taste and smell to the pulp of a green apple. An extraordinary *chamæmelum* is mentioned in the *Acta Helvetica*. M. Bonnet, in his *Recherches sur l'usage des feuilles*, mentions likewise some monstrous productions which have been found in fruits with kernels, analogous in their nature to those which occur in the flowers of the ranunculus and of the rose-tree. He has seen a pear, from the eye of which issued a tuft of 13 or 14 leaves, very well shaped, and many of them of the natural size. He has seen another pear which gave rise to a ligneous and knotty stalk, on which grew another pear somewhat larger than the first.—The stalk had probably flourished, and the fruit had formed. The *lilium album polyanthos*, observed some years ago at Breslaw, which bore on its top a bundle of flowers, consisting of 102 lilies, all of the common shape, is well known. M. Reynier has mentioned some individuals monstrous with respect to the flower, in the *Journal de Physique et d'Histoire Naturelle*, for November 1785. He has likewise mentioned a monstrous tulip which is seen in the gardens of some amateurs; juniper berries with horns; a balsamine with three spurs, &c.

These vegetable productions, which are so extraordinary, and so contrary to the common course of things, do nevertheless present deviations subject to particular laws, and reducible to certain principles, by distinguishing such as are perpetuated either by seed or by transplanting, from those which are only accidental and passing. Monstruosities which are perpetuated exist in the original organization of the seed of the plant, such as marked or curled leaves, &c. The word *monster* is more properly applied to those irregularities in plants which arise from frequent transplantation, and from a particular culture, such as double flowers, &c.: but those monstruosities which are not perpetuated, and which arise from accidental and transient causes deranging the primitive organization of the plant, when it comes to be unfolded, as is the effect of diseases, of heat or cold, of a superfluity or scarcity of juices, of a depravation of the vessels contributing to nutrition, of the sting of insects, of contusions and natural graffs, retain also the name of *monsters*. Of this kind are knobs or swellings, stunting, gall-nuts, certain streaks, and other similar defects. All the parts of plants are subject to some of these monstruosities, which vary with respect to their situation, figure, proportion, and number. Some trees are naturally of so great a size, that they may be considered as a kind of whale species in the vegetable kingdom: of this kind are the baobab and the ceiba. Others, as the oak, the yew, the willow, the lime, and many others, sometimes, though rarely, attain so extraordinary a bulk that they are likewise monsters among the vegetables. It is conjectured, in short, that monsters are more common in the vegetable than in the animal kingdom, because in the latter the methods of propagation are not so numerous. Plants are seldom monstrous in all their parts: some are monstrous only through excess in the calyx and corolla; others are so through defect only in the leaves, stamina, and fruit. Now, a monstruosity, says M. Adanson, has never changed the name or affected the immutability of a species. Every skilful succeeding botanist has arranged these monstruosities in plants among accidental circumstances, which, in whatever manner they are

are propagated, have always a tendency to revert to the order and regularity of their original species when they are multiplied by means of seed; which method of reproduction is the most natural and the most certain for determining the species. One species may be compared with another; but a monster can only be put in comparison with an individual of the species from which it comes. The reader may consult the *Observations Botaniques* of M. Schlotterbec, of the Society of Basil, concerning monsters in plants, wherein he pretends to demonstrate, that in their production nature follows the same course in the vegetable as in the animal kingdom.

MONT-ALBAN, a strong town of Spain, in the kingdom of Arragon, with a strong citadel; seated on the river Riomartin, 44 miles south of Saragossa, and 92 north by west of Valencia. W. Long. 0. 30. N. Lat. 41. 9.

Mont-Didier, an ancient town of France in Picardy, where the kings of France formerly had a palace and kept their court. It is seated on a mountain, 17 miles from Amiens and Compeigne, and 58 north of Paris. W. Long. 2. 34. N. Lat. 49. 39.

Mont-Lheri, a town of the isle of France, 15 miles from Paris. Here are the remains of a tower, which may be seen at a great distance. E. Long. 2. 0. N. Lat. 48. 38.

Mont-Louis, a small but strong town of France, in the Pyrenees, with a strong citadel; seated on an eminence, 430 miles south of Paris. E. Long. 2. 5. N. Lat. 42. 30.

Mont-Luel, a town of France in Bresse, and capital of the territory of Valbonne; seated in a fertile pleasant country on the river Seraine, eight miles from Lyons, and 205 south-east of Paris. E. Long. 5. 8. N. Lat. 45. 49.

Mont-Luzon, a town of France in Bourbonnois; seated on the river Cher, 35 miles south-west of Moulins, and 150 south of Paris. E. Long. 2. 45. N. Lat. 46. 22.

Mont-Blanc. See *Mont-Blanc*.

MONTABOUR, a small fortified town of Germany, in the electorate of Treves, between Coblentz and Limpurg. E. Lon. 7. 50. N. Lat. 50. 30.

MONTAGNIAC, a considerable town of Asia, in Natolia, and in the province of Bec-Sangel, on the sea of Marmora. It carries on a great trade, especially in fruits, and is seated on a bay of the same name, 12 miles from Bursa, and 60 south-east of Constantinople. E. Long. 29. 40. N. Lat. 40. 20.

MONTAGUE (Edward), earl of Sandwich, an illustrious Englishman, who shone from the age of 19, and united the qualifications of general, admiral, and statesman; yet there were strange inconsistencies in his character. He acted early against Charles I; he persuaded Cromwell, whom it is said he admired, to take the crown; and he was zealous for the restoration of Charles II. All this is imputed to a fond and unaccountable passion which he had for royalty. Upon general Monk's coming into England, he sailed with the fleet to Holland, and soon after he had the honour to convoy his majesty to England. For this he was created knight of the garter; and on the 12th of July 1660 he was created baron Montague of St Neot's in the county of Huntingdon, Viscount Hinchinbrooke in the same county, and earl of Sandwich in Kent, sworn one of his majesty's most honourable privy-council, made master of the king's wardrobe, admiral of the Narrow Seas, and lieutenant-admiral to the duke of York, as lord high admiral of England.

When the Dutch war broke out in 1694, and the duke of York took upon himself the command of a fleet as high-admiral, his lordship commanded the blue squadron, and by his industry and care abundance of the enemies ships were taken; and in the great battle fought on the third of June 1665, in which the Dutch lost admiral Opdam, and had 18 men of war taken and 14 destroyed, a large share of the honour of the victory was justly given to the conduct of the earl of Sandwich. On the return of the English navy, the command of the whole fleet was given to the earl of Sandwich, which he was ordered to put as speedily as possible in a condition to return to the coast of Holland. Accordingly the earl sailed on the 5th of July with 60 men of war to the Dutch coast; when finding that their East India and Smyrna fleets were to return home north about, he steered for the coast of Norway, and found they had taken shelter in the port of Bergen, where the fleet were attacked: but leaving them there, and sailing back towards the coast of Holland, he met with four Dutch East Indiamen, with several other merchant ships, under a good convoy, and took eight men of war, two of their East India ships, and 20 sail of merchant men; and a few days after, a part of the fleet falling in with 18 of the Hollanders, the greatest part of them were also taken, with four Dutch men of war, and above 1000 prisoners. On his return he was received by the king with distinguished marks of favour; and soon after, he was sent ambassador extraordinary to the court of Madrid, to mediate a peace between the crowns of Spain and Portugal; when he had the happiness to conclude a peace between the two nations to their mutual satisfaction.

On the breaking out of the last Dutch war, his lordship went to sea with the duke of York, and commanded the blue squadron; the French admiral, count d'Estrees, commanding the white. The fleet was at sea in the beginning of the month of May; and coming to an anchor in Southwold-bay in order to take in water, we are told, that on the 27th many officers and seamen were permitted to go on shore, and were at Southwold, Dunwich, and Aldborough; when, the weather being hazy, the earl gave it as his opinion, that, the wind standing as it did, the fleet rode in danger of being surprised by the Dutch; and indeed, between two and three the next morning, they were informed of their approach, upon which his royal highness made the signal for weighing anchor. The blue squadron was out first, the red next, and the white was much astern. The earl of Sandwich in the Royal James, which carried 100 guns, began the fight, and fell furiously on the squadron of Van Ghent in order to give the rest of his fleet time to form; when captain Brakel, in the Great Holland, attacked the Royal James; but was soon disabled, as were several other men of war, and three fire-ships sunk. By this time most of his men were killed; and the hull of the Royal James was so pierced with shot, that it was impossible to carry her off. In this distress he might have

Montague. been relieved by his vice-admiral Sir Joseph Jordan, had not that gentleman been more solicitous about assisting the duke. When therefore he saw him sail by, heedless of the condition in which he lay, he said to those who were about him, "There is nothing left for us now, but to defend the ship to the last man." Being at length grappled by a fourth fire-ship, he begged his captain Sir Richard Haddock, and all his servants, to get into the boat and save themselves, which they did: yet some of the sailors refused to quit the admiral, and staying endeavoured to extinguish the fire, but in vain; the ship blew up about noon. His lordship's body was found about a fortnight after, and was interred with great state in Henry VII.'s chapel.—We have of his lordship's writing, 1. The Art of Metals, in which is declared the manner of their generation, translated from the Spanish of Albaro Alonzo Barba, 8vo. 2. Several letters during his embassy to Spain, published with Arlington's letters. 3. A letter to secretary Thurloe. 4. Original letters and negociations of Sir Richard Fanshaw, the earl of Sandwich, the earl of Sunderland, and Sir William Godolphin, wherein divers matters between the three crowns of England, Spain, and Portugal, from the year 1663 to 1678, are set in a clear light, 2 vols 8vo.

Montague (Charles), earl of Halifax, fourth son of George Montague of Harton in Northamptonshire, Esq; son of Henry the first earl of Manchester, was born in 1661. He was educated at Westminster-school and Cambridge, showed very early a most pregnant genius, and quickly made great progress in learning. In 1684, he wrote a poem on the death of King Charles II. in which he displayed his genius to such advantage, that he was invited to London by the earl of Dorset: and upon his coming thither he soon increased his fame, particularly by a piece which he wrote in conjunction with Prior, published at London in 1687, under the title of, "The Hind and the Panther transversed to the Story of the Country-mouse and the City-mouse." Upon the abdication of King James II. he was chosen one of the members of the convention, and recommended by the earl of Dorset to King William, who immediately allowed him a pension of 500 l. *per annum*. Having given proofs of his great abilities in the house of commons, he was made one of the commissioners of the treasury, and soon after chancellor of the exchequer: in which post he brought about that great work of recoining all the current money of the nation. In 1698, he was appointed first commissioner of the treasury; and in 1699 was created a peer of England, by the title of *Baron Halifax* in the county of York. In 1701, the house of commons impeached him of six articles, which were dismissed by the house of Lords. He was attacked again by the house of commons in 1702, but without success. In 1705, he wrote, An Answer to Mr Bromley's Speech in relation to the occasional Conformity-bill. In 1706, he was one of the commissioners for the Union with Scotland; and upon passing the bill for the naturalization of the illustrious house of Hanover, and for the better security of the succession of the crown in the Protestant line, he was made choice of to carry that act to Hanover. Upon the death of Queen Anne, when the king had taken possession of his throne, his lordship was appointed first commissioner of the treasury, and created earl of Halifax and knight of the garter. He died in 1715. His lordship wrote several other pieces besides those above-mentioned; all which, with some of his speeches, were published together in 1716 in an octavo volume.

Montague (Lady Mary Wortley) accompanied her husband who was sent on an embassy to Constantinople in the beginning of this century. On her return she introduced the practice of inoculation into England, and thence acquired great celebrity. She cultivated the belles lettres; and at one period of her life she was the friend of Pope, and at another his enemy. While they were at enmity with each other, Lady Mary Montague embraced every opportunity of defaming the poet, who well knew how to take revenge. Both of them carried their animosity to so great a height, that they became the subject of public conversation. After a long life, full of singular and romantic adventures, she died about the year 1760. From her we have *Letters*, written during her travels from the year 1716 to the year 1718. They have been translated into French, and published at Rotterdam 1764, and at Paris 1783, one vol. 12mo. They are composed in a lively, interesting, and agreeable style, and contain many curious facts relating to the manners and government of the Turks, which are no where else to be found. The Baron de Tott, who lived many years at Constantinople, attacked them with great severity; but they have been defended with equal zeal by M. Guis of Marseilles, who has published a valuable work on Turkey. It need not appear extraordinary, that persons who have visited the same country should not see things in the same light. How few travellers agree in their accounts of the same objects, which they nevertheless pretend to have seen and to have examined with attention.

Montague (Edward Wortley), son of the former, passed through such variegated scenes, that a bare recital of them would savour of the marvellous. From Westminster-school, where he was placed for education, he ran away three several times. He exchanged clothes with a chimney-sweeper, and he followed for some time that sooty occupation. He next joined himself to a fisherman, and cried flounders in Rotherhithe. He then sailed as a cabin-boy to Spain; where he had no sooner arrived, than he ran away from the vessel, and hired himself to a driver of mules. After thus vagabondising it for some time, he was discovered by the consul, who returned him to his friends in England. They received him with a joy equal to that of the father of the prodigal son in the gospel. A private tutor was employed to recover those rudiments of learning which a life of dissipation, of blackguardism, and of vulgarity, might have obliterated. Wortley was sent to the West Indies, where he remained some time; then returned to England, acted according to the dignity of his birth, was chosen a member, and served in two successive parliaments. His expences exceeding his income, he became involved in debt, quitted his native country, and commenced that wandering traveller he continued to the time of his death. Having visited most of the eastern countries, he contracted a partiality for their manners. He drank little wine; a great deal of coffee; wore a long beard; smoked much; and,

and, even whilſt at Venice, he was habited in the eaſtern ſtyle. He ſat croſs-legged in the Turkiſh faſhion through choice. With the Hebrew, the Arabic, the Chaldaic, and the Perſian languages, he was as well acquainted as with his native tongue. He publiſhed ſeveral pieces. One on the "Riſe and Fall of the Roman Empire." Another an exploration of "The Cauſes of Earthquakes." As this gentleman was remarkable for the uncommon incidents which attended his life, the cloſe of that life was no leſs marked with ſingularity. He had been early married to a woman who aſpired to no higher a character than that of an induſtrious waſherwoman. As the marriage was ſolemnized in a frolic, Wortley never deemed her ſufficiently the wife of his boſom to cohabit with her. She was allowed a maintenance. She lived contented, and was too ſubmiſſive to be troubleſome on account of the conjugal rites. Mr Montague, on the other hand, was a perfect patriarch in his manners. He had wives of almoſt every nation. When he was with Ali Bey in Egypt, he had his houſehold of Egyptian females, each ſtriving who ſhould be the happy ſhe who could gain the greateſt aſcendency over this Anglo-Eaſtern baſhaw. At Conſtantinople, the Grecian women had charms to captivate this unſettled wanderer. In Spain a Spaniſh brunette, in Italy the olive-complexioned female were ſolicited to partake the honours of the bridal-bed. It may be aſked what became of this group of wives? Mr Montague was continually ſhifting the place, and conſequently varying the ſcene. Did he travel with his wives as the patriarchs did with their flocks and herds? No ſuch thing. Wortley, conſidering his wives as bad travelling companions, generally left them behind him. It happened, however, that news reached his ears of the death of the original Mrs Montague the waſherwoman. Wortley had no iſſue by her; and without iſſue male, a very large eſtate would revert to the ſecond ſon of lord Bute. Wortley, owing the family no obligations, was determined, if poſſible, to defeat their expectations. He reſolved to return to England and marry. He acquainted a friend with his intentions; and he commiſſioned that friend to advertiſe for any young decent woman who might be in a pregnant ſtate. Several ladies anſwered it. One out of the number was ſelected, as being the moſt eligible object. She waited with eagerneſs for the arrival of her expected bridegroom; but, behold, whilſt he was on his journey, death very impertinently arreſted him in his career.

Montague-Iſland, one of the Hebrides, in the South Sea, near Sandwich Iſland. E. Long. 168. 37. S. Lat. 17. 26.

MONTAIGNE (Michel de), a French gentleman, was born in Perigord in 1533. His father educated him with great care, and made him learn Latin as other children learn their mother-tongue. His tutors were Nicholas Gronchi, who wrote *De Comitiis Romanorum;* William Guerenti, who wrote on Ariſtotle; George Buchanan; and M. Anthony Muret. He was alſo taught Greek by way of recreation; and becauſe ſome think that ſtarting children out of their ſleep ſpoils their underſtanding, he was awakened every morning with the ſound of muſic. He was counſellor for a while in the parliament of Bourdeaux; afterwards made mayor of Bourdeaux. He publiſhed his *Eſſays*, ſo much known in the world, in 1580. Montaigne had a great deal of wit and ſubtlety, but no ſmall ſhare of conceit and vanity. The learned and ingenious are much divided in their opinion about his works. He died in 1592.

MONTALCINO, a ſmall populous town of Italy, in Tuſcany, and in the territory of Sienna, with a biſhop's ſee. It is ſeated on a mountain, 17 miles ſouth-eaſt of Sienna, and 44 ſouth-eaſt of Florence. E. Long. 11. 30. N. Lat. 43. 7.

MONTALTO, an epiſcopal town of Italy, in the Marca of Ancona; ſeated on the river Monacio, 10 miles north of Aſcolii, and 45 ſouth of Ancona. E. Long. 13. 30. N. Lat. 42. 54.

MONTANINI (Pietro), called *Petruccio Perugino*, an eminent landſcape painter, was born at Perugia in 1619. At firſt he was inſtructed by his uncle Pietro Barſotti; but was afterwards placed as a diſciple with Ciro Ferri. Yet he did not long adhere to the manner of either of thoſe maſters, chooſing preferably to ſtudy under Salvator Roſa; and he imitated the ſtyle of that celebrated painter with exceeding great ſucceſs. The taſte of his landſcapes was generally admired; the rocks, ſituations, torrents, and abrupt precipices, were deſigned with ſpirit, and in a grand ſtyle; and his figures recommended themſelves to the eye by a very uncommon correctneſs, propriety, and elegance. He died in 1689.

MONTANISTS, Chriſtian heretics, who ſprung up about the year 171, in the reign of the emperor Marcus Aurelius They were ſo called from their leader, the hereſiarch Montanus, a Phrygian by birth; whence they are ſometimes ſtyled *Phrygians* and *Cataphrygians*.

Montanus, it is ſaid, embraced Chriſtianity in hopes of riſing to the dignities of the church. He pretended to inſpiration; and gave out, that the Holy Ghoſt had inſtructed him in ſeveral points, which had not been revealed to the apoſtles. Priſcilla and Maximilla, two enthuſiaſtic women of Phrygia, preſently became his diſciples; and in a ſhort time he had a great number of followers. The biſhops of Aſia, being aſſembled together, condemned his prophecies, and excommunicated thoſe who diſperſed them. Afterwards they wrote an account of what had paſſed to the weſtern churches, where the pretended prophecies of Montanus and his followers were likewiſe condemned.

The Montaniſts, finding themſelves expoſed to the cenſure of the whole church, formed a ſchiſm, and ſet up a diſtinct ſociety under the direction of thoſe who called themſelves *prophets*. Montanus, in conjunction with Priſcilla and Maximilla, was at the head of the ſect.

Theſe ſectaries made no alteration in the creed. They only held, that the Holy Spirit made Montanus his organ for delivering a more perfect form of diſcipline than what was delivered by the apoſtles. They refuſed communion for ever to thoſe who were guilty of notorious crimes, and believed that the biſhops had no authority to reconcile them. They held it unlawful to fly in time of perſecution. They condemned ſecond marriages, allowed the diſſolution of marriage, and obſerved three lents.

The Montaniſts became ſeparated into two branches; one of which were the diſciples of Proclus, and the other

other of Æſchines. The latter are charged with following the heterodoxy of Praxeas and Sabellius concerning the Trinity.

MONTANUS (Benedict Arias), a moſt learned Spaniſh theologian, born in the dioceſe of Badajox, about the year 1528. He aſſiſted at the council of Trent with great reputation; and his merit and writings recommended him to Philip II. of Spain, who employed him in publiſhing a new polyglot bible after the Complutenſian edition, which was printed by the care of Cardinal Ximenes. This bible was printed at Antwerp, whither Montanus went in 1571; and on his return to Spain he refuſed the biſhopric which Philip offered him for his reward, but ſpent the reſt of his days at Sevilla, where he died about the year 1598. Montanus had not only vaſt erudition, but great good ſenſe; he loved ſolitude, was very laborious, never drank wine, and ſeldom ate fleſh.

MONTARGIS, a conſiderable town of France, in the Orleannois, and capital of the Gatinois; ſeated on the river Loir, near a handſome foreſt, 15 miles ſouth of Nemours, and 62 ſouth of Paris. E. Long. 2. 36. N. Lat. 48. 1.

MONTAUBAN, a conſiderable town of France, in Guienne, and territory of Quercy, with a biſhop's ſee, and an academy. The fortifications were demoliſhed in 1629, becauſe it took the part of the Huguenots. It is ſeated on the river Tarne, 20 miles north of Toulouſe, and 30 ſouth of Cahors. E. Long. 1. 27. N. Lat. 43. 56.

MONTBAZON, a town of France, in Touraine, with the title of a duchy; agreeably ſeated at the foot of a hill, on which there is an ancient caſtle, 135 miles ſouth-weſt of Paris. E. Long. 0. 45. N. Lat. 47. 17.

MONTBELLIARD, a handſome and ſtrong town of France, capital of a province of the ſame name, between Alſace and the Franche Compte. It is ſeated at the foot of a rock, on which there is a large, ſtrong caſtle, in the form of a citadel. The prince of Montbelliard has a voice and ſeat in the college of the princes of the empire. It was taken by the French in 1674, who demoliſhed the fortifications, but it was reſtored to the prince. It is ſeated near the rivers Alaine and Doux, 33 miles weſt of Baſle, and 45 north-eaſt of Bezanzon. E. Long. 6. 30. N. Lat. 47. 31.

MONTBLANC, a town of Spain, in the province of Catalonia, 15 miles north of Tarragon. E. Long. 1. 5. N. Lat. 41. 20.

MONTBRISION, a conſiderable town of France, and capital of Forez, ſeated on the river Veziza, 40 miles weſt of Vienne, and 250 ſouth by eaſt of Paris. E. Long. 4. 27. N. Lat. 45. 32.

MONTECCHIO, a conſiderable town of Italy, in the duchy of Reggio, 10 miles ſouth-eaſt of Parma, and eight north-weſt of Reggio. E. Long. 15. 54. N. Lat. 38. 8.

MONTE-FALCO, a town of Italy, in the territory of the church and duchy of Spalatto; ſeated on a mountain near the river Clitunno, 12 miles weſt of Spalatto E. Long. 12. 40. N. Lat. 42 58.

Monte-Falcone, a town of Italy, in Friuli, with a caſtle. It belongs to the Venetians, and is near the river Ponzano, 10 miles north-weſt of Aquileia, and 12 north weſt of Trieſte. E. Long. 13. 0. N. Lat. 46. 4.

Monte-Faiſcone, a ſmall but populous town of Italy, in the territory of the Church, with a biſhop's ſee; ſeated on a mountain, near the lake Bolſena, in a country abounding with excellent wine, 12 miles ſouth-weſt of Orvieto, and 45 north-weſt of Rome. E. Long. 12. 4. N. Lat. 42. 26.

Monte-Marano, a populous towm of Italy, in the kingdom of Naples, and in the Farther Principato; ſeated on the river Calore, 18 miles ſouth of Benevento. E. Long. 15. 0. N. Lat. 40. 48.

Monte-Mor-o-novo, or *Monte-major-el-novo*, a conſiderable town of Portugal, on the road from Liſbon to Badajoz. Long. 9. 35. W. N. Lat. 38. 42.

Monte-Mor-o-velho, or *Monte-major-el-velho*, a town of Portugal in the province of Beira, with a very large caſtle, ſeated in a fertile country, 10 miles ſouth-weſt of Coimbra, and 83 north of Liſbon. W. Long. 8. 9. N. Lat. 40. 5.

Monte-Peloſo, an epiſcopal town of Italy, in the kingdom of Naples, and in the Baſilicata; ſeated on a mountain near the river Baſiento, 14 miles eaſt of Cirenza. E. Long. 16. 28. N. Lat. 40. 46.

Monte-Pulſiano, a town of Italy, in Tuſcany, with a biſhop's ſee; ſeated on a high mountain, near the river Chiana, in a country noted for excellent wine, 25 miles ſouth-eaſt of Sienna, and 50 ſouth by eaſt of Florence. E. Long. 11. 49. N. Lat. 43. 10.

Monte-Sancto, formerly called *Mount-Athos*, a mountain of Turky in Europe, on the gulph of Conteſſa. It is called Monte-Sancto, or the Holy Mount, becauſe there are 22 monaſteries thereon, in which are 4000 monks, who never ſuffer a woman to come near them. It is 17 miles ſouth of Salonichi. E. Long. 24. 39. N. Lat. 40. 27.

Monte-Verde, a town of Italy, in the kingdom of Naples, and in the farther Principato, with a biſhop's ſee; 60 miles eaſt of Naples. E. Long. 15. 42. N. Lat. 40. 51.

MONTECUCULI (Raymond de), generaliſſimo of the emperor's army, and one of the greateſt commanders of his time, was born in the duchy of Modena, of a diſtinguiſhed family, in 1608. Erneſt Montecuculi his uncle, who was general of the artillery in the Imperial army, reſolved that he ſhould ſerve firſt as a common ſoldier, and that he ſhould paſs through all the military degrees before he was raiſed to command. This the young Montecuculi did with applauſe. In 1644, when he was at the head of 2000 horſe, he ſurpriſed by a precipitate march 10,000 Swedes, who laid ſiege to Nemeſſau in Sileſia, and obliged them to abandon their artillery and baggage; but a ſhort time after, he was defeated and taken priſoner by the general Banier. Having obtained his liberty at the end of two years, he joined his troops to thoſe of John de Wert; and defeated general Wrangel in Bohemia, who was killed in the battle. In 1657 the emperor made him general marſhal de camp; and ſent him to the aſſiſtance of John Caſimir, king of Poland. Montecuculi vanquiſhed Ragotzi prince of Tranſilvania, drove out the Swedes, and diſtinguiſhed himſelf in an extraordinary manner againſt the Turks in Tranſilvania and Hungary. In 1673 he commanded the Imperial army againſt the French, and took Bonne; he then pro-

ceeded with feint marches in order to deceive Turenne, in which he obtained great honour. However, the command of that army was taken from him the next year; but it was reſtored to him in 1675, in order that he might make head againſt the great Turenne. All Europe had their eyes fixed on theſe two able warriors, who then made uſe of all the ſtratagems which genius and military knowledge were capable of ſuggeſting. The marſhal de Turenne was obtaining the ſuperiority when he was taken off by a cannon ball. Montecuculi wept at the death of ſo formidable an enemy, and beſtowed upon him the greateſt praiſes. The great prince de Conde was the only French general that could deprive Montecuculi of the ſuperiority he had obtained by Turenne's death. That prince was therefore ſent to the Rhine, and ſtopped the Imperial general; who conſidered this laſt campaign as the moſt glorious of his life, not from his being conqueror, but for his not being conquered, when he was oppoſed by a Turenne and a Conde. He ſpent the reſt of his life at the Imperial court; and died at Lintz in 1680. He wrote *Memoirs;* the beſt edition of which is that of Straſburg, in 1735,

MONTEGO-BAY, a town of Jamaica, and, next to Kingſton, the moſt flouriſhing in the iſland, contains above 350 houſes; and carries on a very conſiderable commerce with Great Britain and our remaining colonies in North America. The harbour is capacious; but rather expoſed to the north winds, which at certain times in the year blow with great violence It is the capital of the pariſh of St James; in which are 70 ſugar-plantations, 70 other ſettlements, and 27,000 ſlaves.

MONTESA, a very ſtrong town of Spain, in the kingdom of Valentia. It is the ſeat of an order of knighthood of the ſame name; and is five miles from Xativa. W. Long 0. 10. N. Lat. 39. 0.

MONTESQUIEU (Charles de Secondat) baron, a moſt illuſtrious Frenchman deſcended from an ancient and noble family of Guienne, was born at the caſtle of La Brede, near Bourdeaux, in 1789. The greateſt care was taken of his education; and at the age of 20 he had actually prepared materials for his *Spirit of Laws*, by well digeſted extracts from thoſe immenſe volumes of civil law which he had ſtudied, not barely as a civilian, but as a philoſopher. He became a counſellor of the parliament of Bourdeaux in 1714, and was received preſident à mortier two years after. In 1721 he publiſhed his *Perſian Letters*; in which, under the ſcreen of Oriental manners, he ſatirized thoſe of France, and treated of ſeveral important ſubjects by delicate tranſient glances: he did not avow this publication; but was no ſooner pointed out as the author, than zeal without knowledge, and envy under the maſk of it, united at once againſt the Perſian Letters. He was received into the French academy in 1728; and having previouſly quitted his civil employments, he entirely devoted himſelf to his genius, and was no longer a magiſtrate, but a man of letters. Having thus ſet himſelf at liberty, he travelled through Germany, Italy, Switzerland, Holland, and England, in which laſt country he reſided three years, and contracted intimacies with the greateſt men then alive; for Locke and Newton were dead. The reſult of his obſervations was, "that Germany was fit to travel in, Italy to ſojourn in, England to think in, and France to live in." On his return he retired for two years to his eſtate at La Brede, where he finiſhed his work, *On the Cauſes of the Grandeur and Declenſion of the Romans;* which appeared in 1734. The reputation acquired by this laſt work only cleared the way for his greater undertaking, the *Spirit of Laws*, which was printed at Geneva in 2 vols 4to. 1750. This was immediately attacked by the adverſaries of his Perſian Letters, in a multitude of anonymous pamphlets; containing all the reproaches to which a liberal mind is expoſed from craft and ignorance. M. Monteſquieu drew up a defence of this work; which for truth, moderation, and delicacy of ridicule, may be regarded as a model in its way. This great man was peaceably enjoying that fulneſs of eſteem which his great merits had procured him, when he fell ſick at Paris, and died on the 10th of February 1755.—The following character of this great man is drawn by Lord Cheſterfield. His virtues did honour to human nature, his writings juſtice. A friend to mankind, he aſſerted their undoubted and unalienable rights with freedom, even in his own country; whoſe prejudices in matters of religion and government he had long lamented, and endeavoured, not without ſome ſucceſs, to remove. He well knew, and juſtly admired, the happy conſtitution of this country, where fixed and known laws equally reſtrain monarchy from tyranny, and liberty from licentiouſneſs. His works will illuſtrate his name, and ſurvive him, as long as right reaſon, moral obligation, and the true ſpirit of laws, ſhall be underſtood, reſpected, and maintained." As to his perſonal qualities, we are told by his elogiſt, M. d'Alembert, that "he was of a ſweet, gay, and even temper. His converſation was ſpirited, agreeable, and inſtructive. Nobody told a ſtory in a more lively manner, or with more grace and leſs affectation. He had frequent abſence of mind; but always awaked from it by ſome unexpected ſtroke that re-animated the languiſhing converſation. Though he lived with the great, he retired whenever he could to his eſtate in the country, and there met his books, his philoſophy, and his repoſe. Surrounded at his leiſure-hours with peaſants, after having ſtudied man in the commerce of the world, he ſtudied him in thoſe ſimple people ſolely inſtructed by nature. With them he cheerfully converſed; he endeavoured, like Socrates, to find out their genius, and appeared as happy with them as in the moſt brilliant aſſemblies; eſpecially when he reconciled their differences, and by his beneficence relieved them from their diſtreſſes."

Beſides the works already mentioned, M. Monteſquieu wrote ſeveral ſmall pieces, as the Temple of Gnidus, Lyſimachus, and Eſſay upon Taſte, which is left unfiniſhed. His works have been collected ſince his death, and printed at Paris in a ſplendid edition, in quarto. They have likewiſe all of them been tranſlated into Engliſh.

MONTEZUMA, or MONTEÇUMA, was emperor or king of Mexico when Cortez invaded that country in 1518, invited thither, as he pretended, by the inhabitants, whoſe children Montezuma, in the blindneſs of his ſuperſtition, had ſacrificed to his idols. The warlike animals on which the Spaniſh officers were mounted, the artificial thunder with which they were armed, the wooden caſtles on which they had croſſed

the ocean, the armour with which they were covered, the victories which they gained wherever they went; all these circumstances, added to that foolish disposition to wonder which always characterises a simple people, so operated upon the minds of the Mexicans, that when Cortez arrived at the city of Mexico, he was received by Montezuma as his master, and by the inhabitants as a god. At first they fell down in the streets when a Spanish valet passed by; but by degrees the court of Montezuma grew familiar with the strangers, and ventured to treat them as men. Montezuma, unable to expel them by force, endeavoured to inspire them with confidence at Mexico by expressions of friendship, while he employed secret means to weaken their power in other quarters. With this view, one of his generals, who had private orders to that purpose, attacked a party of the Spaniards who were stationed at Vera-Cruz; and, although his troops were unsuccessful, yet three or four of the Spaniards were killed. The head of one of them was carried to Montezuma. In consequence of this, Cortez did what has been reckoned one of the boldest political strokes that ever was performed. He ran to the palace, followed by fifty of his troops; and, by persuasion and threats, carried the emperor prisoner into the Spanish quarter. He afterwards obliged him to deliver up those who had attacked his troops at Vera-Cruz; and, like a general who punishes a common soldier, he loaded Montezuma with chains. He next obliged him to acknowledge himself in public the vassal of Charles V.; and, in name of tribute for this homage, Cortez received 600,000 merks of pure gold. Montezuma soon afterwards fell a sacrifice to his submission to the Spaniards. He and Alvaro, the lieutenant of Cortez, were besieged in the palace by 200,000 Mexicans. The emperor proposed to show himself to his subjects, that he might persuade them to desist from the attack: but the Mexicans no longer considered him in any other light but as the slave of foreign conquerors. In the midst of his speech, he received a blow with a stone which wounded him mortally; and he expired soon after, A. D. 1520.—See CORTEZ. This unfortunate prince left two sons and three daughters, who embraced the Christian faith. The eldest received baptism, and obtained from Charles V. lands, revenues, and the title of Count de Montezuma. He died in 1608; and his family is one of the most powerful in Spain.

MONTFAUCON (Bernard de), a very learned Benedictine of the congregation of St Maur, singularly famous for his knowledge in Pagan and ecclesiastical antiquities, was born of an ancient and noble family in Languedoc, in 1655. He served for some time in the army; but the death of his parents mortified him so with regard to the world, that he commenced Benedictine monk in 1675, and applied himself intensely to study. Though Montfaucon's life was long, healthy, retired, and laborious, his voluminous publications seem sufficiently to have employed the whole; exclusive of his greatest undertaking, for which he will be always memorable. This was his *Antiquité expliqué*, written in Latin and French, illustrated with elegant plates, in 10 vols folio; to which he added a supplement of 5 vols more. He died at the abbey of St Germain in 1741.

MONTFERRAT, a province of Italy, with the title of a duchy; bounded on the east by the duchy of Milan, and part of the territory of Genoa; on the north, by the Vercellese and Canavese; on the west, by Piedmont properly so called; and on the south by the territory of Genoa, from whence it is separated by the Apennine mountains. It contains 200 towns and castles; and is very fertile and well cultivated, abounding in corn, wine, oil, and silk. It belongs to the king of Sardinia, and Casal is the capital town.

MONTFORT, a town of France, in Upper Bretagne, seated on the river Men, 12 miles from Rennes. W. Long. 1. 58. N. Lat. 48. 8.

MONTFORT, an handsome and strong town of the Netherlands, in the United Provinces, with an ancient castle; seated on the river Yssel, seven miles from Utrecht. E. Long. 5. 0. N. Lat. 52. 4.

MONTFORT, a town of Germany, in the circle of Suabia, on the confines of Tirol, 16 miles south of Lindow, and the lake Constance. It is capital of a country of the same, which has been almost all purchased by the house of Austria. E. Long. 9. 51. N. Lat. 47. 22.

MONTFORT-DE-LEMOS, an ancient town of Spain, in the kingdom of Galicia, with a magnificent castle, where the Comarca of Lemos resides. It is seated in a fertile country, 25 miles north-east of Orensa, and 55 south-east of Compostella. W. Long. 7. 9. N. Lat. 42. 28.

MONTFORT-L'AMULY, a town in the Isle of France, with the title of a duchy, 25 miles from Paris. E. Long. 2. 50. N. Lat. 48. 45.

MONTFORT (Simon Count de), descended from an illustrious and flourishing family, was lord of a small town of the same name ten leagues from Paris. He was one of the greatest generals of the age in which he lived; and he displayed his bravery in a voyage beyond seas, and in the wars with the English and Germans. The strength of his constitution enabled him to support without inconvenience the severest labours of the field: his majestic stature distinguished him in the midst of the battle; and the motion of his sword was sufficient to strike terror into his boldest enemies. In the greatest dangers he possessed the utmost coolness and presence of mind: he observed every emergency; and was ready to bring assistance, while he himself was employed in attacking the bravest who made head against him. He was appointed to conduct the crusade against the Albigenses in 1209; and the name of Simon de Montfort is highly celebrated in this war. He took Beziers and Carcassonne, raised the siege of Castelnau, and gained a great victory in 1213 over Peter king of Arragon, Raimond VI. count of Toulouse, and the counts de Foix and de Cominge. Simon de Montfort was killed at the siege of Toulouse on the 25th of June 1218, by a blow with a stone discharged by the hands of a woman.—Such was the fate of one who had sullied the glory of his victories by the cruelty of his executions.—Some historians have given him the name of *Maccabeus* and of *Defender of the Faith*; but men, animated with the true spirit of Christianity, have revolted against such titles. "We cannot (says the Abbé Nonotte) read the accounts of his severity, or rather cruelty, towards the Albigenses without horror. He was not guided by the spirit of the religion of Jesus

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sus in the massacre of Beziers, the pillage of Carcassonne, and the taking of Lavaur. But our horror is somewhat diminished by the consideration of the dreadful revolt, and massacres committed by the Albigenses themselves." Simon de Montfort treated them at the best with as great cruelty as they had done the Catholics. His younger son afterwards made a great figure in England, and is known by the title of Earl of Leicester.

MONTGATZ, a town of Lower Hungary, in the county of Pereczas, with a fortress composed of three castles, seated on a craggy rock. It is encompassed with a great morass, and art and nature have rendered it almost impregnable. It was defended by the Princess Ragotsky, wife of Count Tekeli, when besieged by an army of the Imperialists, who were obliged to raise the siege in 1688.

MONTGERON (Louis-Basile-Carré de), was born at Paris, A. D. 1686; his father was master of requests. He was scarcely 25 years of age when he purchased the place of counsellor in parliament, where by his wit and external qualifications he gained considerable reputation. Deeply engaged in all the vices which flow from irreligion, he was converted by an unexpected circumstance. He went on the 7th of September 1731 to the tomb of Deacon Paris, with an intention to examine, with the rigour of the severest critic, the miracles which were reported to be performed there. But, according to his own account, he felt himself suddenly beat to the earth by innumerable flashes of light with which he was surrounded. His incredulity was converted into flaming zeal, and he became the apostle of the saint whom he formerly ridiculed. From that moment he devoted himself to the fanaticism of *convulsions*, with the same impetuosity of character with which he had run into the most shameful excesses. He had not long been the disciple of Jansenism when he suffered persecution. When the chamber of inquests was banished in 1732, he was sent into the mountains of Auvergne; which, instead of cooling, tended rather to inflame his zeal. During his exile, he formed the plan of collecting the proofs of the miracles wrought at the tomb of the Abbé Paris, and of composing what he called a *Demonstration of them*. On his return to Paris, he prepared to execute this plan; and on the 29th of July 1737, he actually presented to the king at Versailles a volume in quarto superbly bound. This work he accompanied with a speech, which is a mixture of zeal and argument in a tolerable style. In consequence of this work, which some consider as a masterpiece of eloquence, and others as a mass of absurdities, he was committed to the Bastile. After a few months confinement, he was sent to an abbey of Benedictine monks in the diocese of Avignon; whence he was, in a short time, carried to Viviers. He was afterwards confined in the citadel of Valence, where he died, A. D. 1754, aged 68. The work which he presented to the king was entitled *La verité des Miracles operées par l'intercession de M. Paris*, &c. &c.—The critics, even to this day, seem to be guided in their opinion concerning this book either by hatred or by enthusiasm. "It would be extremely rash (says the Abbé de St Pierre, in the second volume of his *Annales*, p. 593.) to maintain with the Molenists, that no miraculous cure was ever performed at the tomb of the Abbè Paris; and to say with the Jansenists, that these cures were performed by a supernatural power, would be the height of fanaticism The truth is (adds the same author), that no miracle appears ever to have been performed at this tomb except in the cure of the human body; in all other cases, there would have been the want of that imagination on which the whole miracle depended." Thus, although Montgeron ventured to compare these prodigies with the miracles of Jesus Christ and his apostles, yet we find no person raised from the dead, no multiplication of loaves, no command obeyed by the elements, and no blind or deaf restored to their sight or hearing. It belongs to the Author of nature alone, or to those who have derived power from him, to work such miracles as are recorded by the evangelists, or in the history of the apostles. Montgeron added a second and third volume on the same subject: he left also in manuscript a work which he composed in prison *contre les Incredules*. Religion, it must be confessed, has had much more powerful advocates. Fortunately Pascal and Bossuet are among the number: and it could well have wanted both Paris and Montgeron, whatever virtues they might possess in other respects.

Montgomery.

MONTGOMERY, the capital of a county of the same name in North Wales, 158 miles from London, took its name from Roger de Montgomery earl of Shrewsbury, who built the castle: but it is called by the Welsh *Tre Valdwin*, that is, Baldwin's town; having been built by Baldwin, lieutenant of the marches of Wales, in the reign of William I. The Welsh, after having put the garrison to the sword, demolished it in 1095; but Henry III. rebuilt it, and granted it the privileges of a free borough, with other liberties. It is a large and tolerably well built town, in a healthful situation and fertile soil. It sends a member to parliament, and has the title of an earldom. It had formerly a tower and castle; but they were demolished in the civil wars. It has a weekly market, and four fairs.

MONTGOMERY (Gabriel de), count de Montgomery in Normandy, was remarkable for his valour and noble atchievements, but still more so for being so unfortunate as to put out the eye of Henry II. on the 29th of June 1559. That prince having engaged several knights in a tournament, given by him on occasion of the marriage of his daughter the princess Elizabeth with Philip king of Spain, at last wished to break a lance with the young Montgomery, at that time lieutenant of the Scotch guard. Montgomery, as if he had foreseen the fatal consequences, again and again declined the combat, and it was with great reluctance he at length yielded, when he saw the king about to take offence at his refusal. In the course, his lance broke in the king's visor, and wounded him in the eye. Henry died on the 11th day after receiving the wound, and gave orders on his death-bed that Montgomery should not be prosecuted, or harassed in any respect, on account of what had happened. After this unlucky accident, Montgomery retired for some time to his estate in Normandy. He next visited Italy and other foreign countries; and did not return to France till the commencement of the civil wars, when he joined the party of the Protestants, and became one of their principal leaders. In 1562, he defended Rouen against the royal army with great valour and obstinacy. The city being at length taken by storm, he

Montgomery.

he threw himself into a galley; and having, with equal temerity and good fortune, surmounted by dint of rowing a chain which had been thrown across the Seine at Candebec for the purpose of preventing succours from England, he escaped to Havre. In 1569 Montgomery was sent to the assistance of Bearn, which the Catholics, under the command of Terrides, had almost entirely wrested from the hands of Jane d'Albret, queen of Navarre. He executed this commission with so great dispatch, that Terrides was obliged to raise the siege of Navarreins, and to retire with great precipitation to Orthez. Montgomery pursued him to this city, which he took by assault; and before Terrides had time to recover himself, he and his principal officers were taken prisoners in the castle. After this defeat, the rest of Bearn submitted to the conqueror wherever he made his appearance. This expedition acquired him the greatest glory, and has been celebrated by the Catholic no less than by the Protestant historians. He was at Paris at the time of the massacre on St Bartholomew's day 1572, and lodged in the Faubourg St Germain. Some accident having retarded the execution in that quarter, he was informed of it at the very moment when it was about to begin; and he had just sufficient time to mount his horse, and, in company with some Protestant gentlemen who lodged near him, to make his escape at full gallop. They were pursued as far as Montfort-l'Amaury; and Montgomery, whose escape alone is particularly attended to, owed his safety on this occasion to the swiftness of his horse, which, according to a manuscript of that time, carried him 30 leagues without halting. Having escaped this danger, he took refuge with his family, first in the island of Jersey and afterwards in England. The following year, Montgomery carried a considerable fleet, which he had armed and fitted out in England, partly on his own credit and partly on that of the inhabitants of Rochelle, to the relief of that city, which was at that time besieged by the Catholics: But, whether distrusting his forces, or for other reasons about which historians do not agree, he left the road without fighting the Catholic fleet, and went to pillage Belleisle on the coast of Brittany. Having disbanded his fleet, he returned to England to Henry de Champernon his son-in law, coast-admiral of Cornwall. On the renewal of the war in France in 1573, Montgomery, who was then in Jersey, passed over into Normandy, and joined the Protestant nobility of that province. Matignon, lieutenant-general in Lower Normandy, to whom Catharine de Medicis had given a particular charge to use his utmost endeavours to seize the person of the Count, came unexpectedly upon him in Saint-Lo, and laid siege to that city. On the evening of the fifth day of the siege, Montgomery left Saint-Lo with between 60 and 80 horse, forced the guard in the suburbs, and escaped amid a shower of musket bullets, without losing a single man, leaving the command of the place to Coulombieres, François de Briqueville. Montgomery arrived at Domfront May 7. 1754, with only twenty followers, intending to make no longer a stay in that place than was necessary to recruit them after the fatigues of so rapid a march. The same day he was joined by several gentlemen, who brought to his assistance a company of forty horse.—Meanwhile Matignon, informed of his escape, and enraged at having lost his prey, flew at the head of a party of horse, with some companies of foot mounted on horseback, and arrived on the morning of the 9th before Domfront. He blocked up the place on all sides till the infantry and cannon which followed him should arrive. On their arrival, he attacked the city with great violence; and, as it was impossible to defend it, Montgomery was soon obliged to retire into the castle with the garrison, amounting to no more than 150 men, including 80 foot soldiers who guarded the city when he entered it. He sustained a furious assault, fought with the greatest boldness and obstinacy, and exposed himself in the breach like one who wished for death. Perceiving, however, that his soldiers, partly by the fire of the enemy, and partly by constant desertion, were reduced almost to nothing, he capitulated on the 27th of May. Many Protestant historians affirm, that the articles of capitulation were violated with regard to Montgomery; but, not to mention the testimony of others, it appears evident, from the authority of D'Aubigny himself, who of all the Protestant writers is most worthy of credit, that the Count had no promise from Matignon, except personal safety and good treatment while he continued his prisoner. This general gave him no assurance of pardon from the king or the queen-mother. After the capture of Domfront, Matignon conducted his prisoner to Saint-Lo, the siege of which was still going on, in hopes that he might have some influence with his former friend and fellow-soldier to persuade him to surrender. For this purpose, Montgomery was brought to the side of the ditch; and he exhorted Coulombieres, who appeared on the wall, to follow his example. But Coulombieres, full of indignation, reproached him in the severest and most upbraiding terms for his cowardice in entering into a shameful capitulation, instead of dying in the breach like a soldier, with his sword in his hand. This intrepid governor spoke the true sentiments of his heart; for when the assault was made some days after, he was killed defending the breach. In the mean time, Matignon received orders from Catharine de Medicis, now regent of the kingdom by the death of Charles IX. to send Montgomery to Paris under a strong guard. When he arrived there, he was conducted to the gaol belonging to the parliament, and confined in the tower which still bears his name. Commissioners were appointed by the queen to conduct his trial. He was interrogated concerning the conspiracy imputed to the admiral Coligny; but the principal charge on which his condemnation was founded, was his hoisting the English flag on board those ships which he intended for the relief of Rochelle. The sentence by which he was condemned also deprived his children of the title of nobles. When Montgomery heard this part of the sentence read, *If they have not the virtue of nobles to retrieve this loss* (said he), *I consent to their degradation.*—After undergoing a very severe torture, he was carried to the place de Greve, dressed in mourning, and there beheaded on the 26th of June 1574. D'Aubigny, who was present at his execution, and who stood immediately behind Fervaques, says that he appeared on the scaffold with a firm and undaunted countenance; and gives us a pretty long speech which he delivered on that occasion, addressing himself first to the spectators

tators on one ſide of the river, and then to thoſe on the other. When he had finiſhed his ſpeech, he fell down on his knees beſide the block; bade adieu to Fervaques, whom he perceived in the crowd; requeſted the executioner not to cover his eyes; and ſubmitted to his fate with a conſtancy truly admirable.

Montgomery has always been conſidered as a victim to the unjuſt revenge of Catherine de Medicis. It is evident that he could not be proſecuted or puniſhed for the death of Henry II.; but it has been ſaid, that, after a misfortune of this kind, which was productive of ſo many calamities to the ſtate, Montgomery was much leſs excuſable than the other Proteſtants, in carrying arms againſt his ſovereign, the ſon of that very king of whom he had deprived France. This conſideration is mentioned by the Catholics as one reaſon for diminiſhing our concern at the tragical death of this illuſtrious hero. Montgomery married in 1549 Eliſabeth de la Fouche of a noble family in Brittany: he left ſeveral children, but their number is not exactly known.

He was the eldeſt ſon of *James de Montgomery*, Seigneur de Lorges in the Orleannois, one of the braveſt men of his age, and famous under the name of *Lorges* in the wars of Francis I. In 1545 he ſucceeded John Stuart count d'Aubigny in the command of the hundred archers in the Scotch guard; and his ſon was lieutenant, or perhaps captain, in ſurvivancy when he killed Henry II. It is ſingular that the ſame Lorges, father of Montgomery, had wounded Francis I. in the chin with a firebrand, in ſome frolic with that prince. This accident occaſioned the wearing of long beards in France for 50 years. Lorges died aged above 80, a ſhort time after Henry II. He obtained the title of count de Montgomery in 1453, pretending that it belonged to his anceſtors, and that he was deſcended, by the earls of Eglinton in Scotland, from a younger ſon of the ancient houſe of Montgomery eſtabliſhed in England. According to a memoir given by the family to the author of the Genealogical Dictionary, James was the ſon of Robert Montgomery, who left Scotland and entered into the ſervice of the French king about the beginning of the reign of Francis I. and this Robert was grandſon to Alexander Montgomery, couſin by the mother's ſide to James I. king of Scotland.

MONTGOMERYSHIRE, a county of North Wales, 40 miles in length and 37 in breadth; bounded on the north by Merionethſhire and Denbighſhire, on the north-eaſt and eaſt by Shropſhire, on the ſouth by Radnorſhire and Cardiganſhire, and on the weſt by the laſt mentioned county and part of Merionethſhire. It is divided into ſix hundreds; and contains ſix market-towns, 47 pariſhes, about 5660 houſes, and 33,960 inhabitants. It lies in the three ſeveral dioceſes of St Aſaph, Bangor, and Hereford; but ſends only two members to parliament, one for the county, and one for the town of Montgomery. The air is pleaſant and ſalubrious; but this county, being extremely mountainous, is not very fertile, except in the valleys, which afford ſome corn and plenty of paſture; however, the ſouth, ſouth-eaſt, and north-eaſt parts, being much more level, are extremely fruitful, eſpecially a pleaſant vale, through which the Severn glides in beautiful meanders.

Month.

MONTH, the twelfth part of a year. See CHRONOLOGY, n° 17.

MONTH, in its proper acceptation, is that ſpace of time which the moon takes up in paſſing from any certain point to the ſame again, which is called a *periodical month*; or it is the ſpace of time between two conjunctions of the moon with the ſun, which is called a *ſynodical month*. That ſpace of time which the ſun takes up in paſſing through one ſign or 12th part of the zodiac, is alſo called (but improperly) a *month*. So that there are two ſorts of months; *lunar*, which are meaſured by the moon; and *ſolar*, which are meaſured by the ſun. The lunar periodical month conſiſts of 27 days, 7 hours, 43 minutes, 5 ſeconds: The lunar ſynodical month is 29 days, 12 hours, 44 minutes, 3 ſeconds, and 11 thirds. A ſolar month contains, upon a mean calculation, 30 days, 10 hours, 29 minutes, 5 ſeconds.

The Jews, Greeks, and Romans, made uſe of lunar ſynodical months; but, to avoid fractions, they conſiſted alternately of 29 and 30 days. The former, the Romans called *cavi*, and the Greeks χοιλοι; the latter were termed *pleni* and πληρεις.

1. The Hebrew months were ranged differently in their ſacred and in their civil year.

Order of the ſacred Year.	Anſwering to our	Order of the civil Year.	Anſwering to our
1 *Niſan*	Mar.	1 *Tiſri*	Sep.
2 *Jiar*	Apr.	2 *Marſchevan*	Oct.
3 *Sivan*	June	3 *Caſleu*	Nov.
4 *Thammuz*	May	4 *Thebet*	Dec.
5 *Ab*	July	5 *Sebat*	Jan.
6 *Elul*	Aug.	6 *Adar*	Feb.
7 *Tiſri*	Sep.	7 *Niſan*	Mar.
8 *Marſchevan*	Oct.	8 *Jiar*	Apr.
9 *Caſleu*	Nov.	9 *Sivan*	May
10 *Thebet*	Dec.	10 *Thammuz*	June
11 *Sebat*	Jan.	11 *Ab*	July
12 *Adar*	Feb.	12 *Elul*	Aug.

Theſe months being lunar cannot exactly anſwer to our ſolar months; but every Jewiſh month muſt be conceived to anſwer to two of ours, and partake of both. As theſe 12 lunar months conſiſted only of 354 days, the Jews, in order to bring it nearer to the true year, took care every three years to intercalate a 13th month into the number, which they called *ve-adar*, or the ſecond adar. The new moon was always the beginning of the month; and it is ſaid the Jews had people poſted on elevated places, to give notice to the Sanhedrim as ſoon as ſhe made her appearance: After this, proclamation was made by ſound of trumpet, and "the feaſt of the new moon, the feaſt of the new moon," reſounded amongſt the people.

The ancient Hebrew months were of 30 days each, excepting the laſt, which conſiſted of 35; ſo that the year contained 365 days, with an intercalary month at the end of 120 years, which, by abſorbing the odd hours which remained at the concluſion of each year, brought it back nearly to its proper place. This regulation of the year was borrowed from the Egyptians.

2. The months of the Athenian year, as we have before obſerved, conſiſted alternately of 29 and 30 days. The firſt month, according to Meton's reformation of the kalendar, began with the firſt new moon after the ſummer ſolſtice, and was called *hecatombæon*, anſwering to the latter half of June, and the

former

Month. former half of July. The order of the months, with the number of days in each, are as follows:

1 *Hecatombæon,*	30	7 *Posideon,*	30
2 *Metagilnion,*	29	8 *Gamelion,*	29
3 *Boedromion,*	30	9 *Elaphebolion,*	30
4 *Mæmacterion,*	29	10 *Munichion,*	29
5 *Panepsion,*	30	11 *Thargelion,*	30
6 *Anthesterion,*	29	12 *Scirrophorion,*	29

Each month was divided into three decades of days called δεχημερα. The first was called Μηνος αρχομενυ or ισαμενυ, or the decade of the beginning of the month; the second was Μηνος μεσυντος or the decade of the middle; and the third was Μηνος φθινοντος, παυομενυ or ληγοντος, the decade of the expiring month.

The first day of the first decade was termed Νεομηνια, because the first month began with the new moon; the second day was δευτερα ισαμενυ; the third τριτη ισαμενυ, &c. The first day of the second decade was πρωτη μεσυντος, the second δευτερα μεσυντος, &c.—the days of this decade were also called πρωτη επι δεκα, δευτερα επι δεκα, &c. The first day of the third decade was πρωτη επ' εικαδι; the second was δευτερα επ' εικαδι, &c. i. e. the first, second, &c. after 20, because the last decade began on the 20th day. This decade was also counted by inversion thus; φθινοντος δεκατη the 21st, φθινοντος εννατη the 22d, φθινοντος ογδοη the 23d, and so of the rest to the last day of the month, which was called ενη και νεα, the old and the new, because one part of that day belonged to the old and the other to the new moon; but after the time of Demetrius, the last day of the month was called from him Δημητριας; it sometimes was named τριακας.

The Grecian months, thus consisting of 29 and 30 days alternately, fell short of the solar year 11 days 6 hours. To remedy this defect the cycle of four years, called τετραετηρις, was invented.—In this cycle, after the first two years, they added an intercalated month called εμβολιμος, consisting of 22 days; and again, after the expiration of two years more, they inserted another month of 23 days, the fourth part of a day having in the space of four years amounted to a whole year. See YEAR.

3. The Roman year under Romulus consisted of 10 months only, and began with March, which contained 31 days, then followed April which had 30, May 31, June 30, *Quintilis* 31, *Sextilis* 30, September 30, October 31, November 30, December 30. These 10 months containing no more than 304 days, this account was in a short time found to be deficient. Numa Pompilius, therefore, took away one day from each of these six months, April, June, *Sextilis*, September, November, December; and to the six days thus obtained be added 51, which was the number that Romulus's year, in his opinion, wanted to make it perfect. Numa had now 57 days to dispose of; he therefore divided them, and constituted two other months, January and February; the former consisting of 29 and the latter of 28 days. The month of January, which he placed at the winter solstice, he made instead of March to begin the year. Thus Numa's year consisted of 355 days: but this being found 11 days 6 hours short of the solar year, he made use of the intercalation of 90 days at the expiration of eight years perpetually; which number, being made up of the 11 days and a quarter, kept the year pretty well to its place. The beginning of the year in Julius Cæsar's time had anticipated its true place 67 whole days: these he intercalated betwixt November and December; so that the year consisted, for this one time, of 15 months or 445 days. This reformation was called the *Julian correction*, and this year the *year of confusion*. At the end of 12 years, by the ignorance of priests, who did not understand intercalation, 12 days had been intercalated for nine. This was observed by Augustus Cæsar, and rectified, by ordering 12 years to pass without any intercalary days. The order and succession of months was the same as that of Numa: But January, March, May, *Quintilis*, *Sextilis*, October, and December, had each 31 days; April, June, September 30, and February, in common years, 28; but every fourth year or bissextile 29. This, with a very little difference, is the account observed at present. *Quintilis*, in compliment to Julius Cæsar, was called *July*, because in this month he was born; and *Sextilis*, in honour of Augustus, was called *August*; both which names are still continued.—See YEAR.

Each month by the Romans was divided into *kalends*, *nones*, and *ides*, all of which were reckoned backwards. The *kalends* were the first day of the month. The *nones* fell on the seventh, and the *ides* on the 15th, of March, May, July, October—but in all other months the *nones* were on the fifth, and the *ides* on the 13th. For the more easy comprehension of the Roman manner of dating, according to this division of the months, here follows a table.

	March May July October	January August December	April June September November	February
1	*Kalendæ*	*Kalendæ*	*Kalendæ*	*Kalendæ*
2	6	4	4	4
3	5	3	3	3
4	4	*Prid. Non.*	*Prid. Non.*	*Prid. Non.*
5	3	*Nonæ*	*Nonæ*	*Nonæ*
6	*Prid. Non.*	8	8	8
7	*Nonæ*	7	7	7
8	8	6	6	6
9	7	5	5	5
10	6	4	4	4
11	5	3	3	3
12	4	*Prid. Idus*	*Prid. Idus*	*Prid. Idus*
13	3	*Idus*	*Idus*	*Idus*
14	*Prid. Idus*	19	18	16
15	*Idus*	18	17	15
16	17	17	16	14
17	16	16	15	13
18	15	15	14	12
19	14	14	13	11
20	13	13	12	10
21	12	12	11	9
22	11	11	10	8
23	10	10	9	7
24	9	9	8	6
25	8	8	7	5
26	7	7	6	4
27	6	6	5	3
28	5	5	4	*Prid. Kal.*
29	4	4	3	
30	3	3	*Prid. Kal.*	
31	*Prid. Kal.*	*Prid. Kal.*		

N. B. Every leap year, February consisting of 29 days, the 24th and 25th of that month are written *sexto Kal. Mart.*; hence leap year is called *Bissextilis*.

MONTIA, in botany: A genus of the trigynia order, belonging to the triandria clafs of plants; and in the natural method ranking with thofe with which the order is doubtful. The calyx is diphyllous; the corolla monopetalous and irregular; the capfule unilocular and trivalved.

MONTINIA, in botany: A genus of the tetrandria order, belonging to the dioecia clafs of plants. The perianthium of the male is quadridented fuperior; and there are four petals. The female calyx and corolla are as in the male; the filaments barren; the ftyle bifid; the capfule oblong and bilocular.

MONTMEDI, a fmall but ftrong town of France, in Luxemburg, feated on the river Chire, which divides it into the upper and lower towns. It is 22 miles fouth-eaft of Sedan, 27 fouth-weft of Luxemburg, and 135 north-eaft of Paris. E. Long. 5. 23. N. Lat. 49. 32.

MONTMORENCI (Francois Henry de.) See Luxemburg.

MONTMORENCY, a town of France, with the title of a duchy, remarkable for the tombs of the dukes of this name. It is feated on a hill, near a large valley, fertile in fruits, efpecially excellent cherries. E. Long. 2. 24. N. Lat. 48. 59.

Montmorency (Anne de), a peer, marfhal, and conftable, of France, and one of the greateft generals of the 16th century, defended, in 1512, the city of Menziers againft the emperor Charles V. and obliged the count of Naffau to raife the fiege. The following year he was made marfhal of France; and in 1525, following king Francis I. into Italy, he was taken with that prince at the battle of Pavia, which was fought contrary to his advice. The important fervices he afterwards rendered the ftate were rewarded by the fword of conftable of France, with which he was prefented by the king on the 10th of February 1538. He afterwards underwent various revolutions of fortune both at court and in the field. At laft, being wounded at the battle of St Denis, which he gained on the 10th of November 1567, he died of his wounds two days after, at 74 years of age. It is faid, that a cordelier attempting to prepare him for death, when he was covered with blood and wounds, after the battle of St Denis, he replied in a firm and fteady voice: "Do you think that a man who has lived near 80 years with honour, has not learnt to die for a quarter of an hour?"

MONTPELIER, one of the handfomeft towns of France, and the moft confiderable in Languedoc excepting Tholoufe, is fituated in E. Long. 4. 20. N. Lat. 45. 58. It hath a citadel, a bifhop's fee, an univerfity, a royal academy of fciences, and a mint. This town has been long famous for a falubrious air and fkilful phyficians. In reality the air may be falutary in catarrhous confumptions from its drynefs and elafticity; but it is too fharp in cafes of pulmonary impofthumes. The climate, according to fome late travellers, is fo much altered for the worfe, that the inhabitants themfelves fcarce know it to be the fame: it has been changing many years, and every year becomes worfe and worfe. It has been known to rain almoft three months without intermiffion; and at intervals fuch thick ftinking fogs, as nothing but the banks of Newfoundland could equal; and feveral times, for two or three days on a ftretch, the fky is fo heavily loaded, that neither fun, moon, nor ftar, can be feen. In fummer it is fo infufferably hot, that till the cool of the evening there is no ftirring out. Its fituation, though on an eminence, never could be healthy; as between it and the Mediterranean (which is about three leagues diftant) it is one continued marfh and fwamp, ever covered with noxious vapours, which, when the fea-breeze fets in, blows directly on the town and the country adjacent; of the fad effects of which, its unhealthy inhabitants, with their yellow meagre looks, are the moft convincing proofs.

The town has nothing curious to induce a ftranger to ftay longer in it than three or four days, except he arrives there about Chriftmas; at which time it is very gay, as all the nobility of Languedoc meet there at that time to fettle the affairs of the province, though it is not the capital, but efteemed nearly the centre. There is during that time a play, which, with an indifferent concert, are all the public amufements. The people in trade are reputed by the French themfelves to be the greateft extortioners, and fure not to let a penny efcape them, be the means to come at it ever fo unjuft: as an inftance, they had the confcience to charge an Englifh fea officer that died there, 300 livres (twelve guineas and a half) for eight days lodging.

This city ftands upon a rifing ground fronting the Mediterranean, which is about three leagues to the fouthward: on the other fide is an agreeable plain, extending about the fame diftance towards the mountains of the Cevennes. It is reckoned well built, and what the French call *bien percée;* yet the ftreets are in general narrow and the houfes dark. The inhabitants are fuppofed to amount to 40,000: they are fociable, gay, and good tempered, and they trade very largely in wine, cordials, oil, verdigreafe, and falt petre. They have feveral manufactures in filk and woollen goods. There are many Proteftants here and at Nifmes. The markets are well fupplied with fifh, poultry, butcher's meat, and game, at reafonable rates. The wine of the country is ftrong and harfh: Burgundy is dear, and fo is the fweet wine of Frontignan, though made in the neighbourhood of Cette. Liquors of various forts are compounded and diftilled at Montpelier. The environs are extremely pleafant, having on one fide La Place de Peyrou, which forms a fine terrace. From thence, on a clear day, may be feen to the eaftward the Alps, which form the frontiers of Italy; to the fouth-weft, the Pyrenean mountains, which form thofe of Spain, each efteemed fifty leagues diftant; and to the fouthward a moft extenfive view of the Mediterranean. Not far from thence is a noble aqueduct, built like two bridges one above the other; by this water is brought from a mountain at three leagues diftance, into two bafons in a fmall elegant temple at the weft end of the place; and the king's garden, where on certain days public lectures are held on botany. On the other fide of the town is the efplanade, a beautiful walk, bordered on each fide by olive trees, from whence there is a pleafing profpect of the fea and the country adjacent to the town; near which is the citadel, a place of no ftrength, though well walled in, as it is commanded by feveral rifing grounds, and has only a dry ditch. There are commonly kept there four battalions of infantry.—

Montreal. Should an Engliſhman chooſe to reſide here any time, the Grande Rue, that is the great ſtreet, is the genteeleſt quarter to reſide in, where 12 or 18 livres a month is the price for a genteel chamber, which in the time of the ſtates would let for 60; and if he does not chooſe to meſs with the officers, there is a genteel ordinary, where the Engliſh commonly eat, in the Rue d'Argenterie, which is contiguous to your lodgings. Families who reſide here find their account in keeping houſe; and every traveller who deſigns to ſtay longer than a day or two in any of theſe towns, will do well to write beforehand to his correſpondent to procure furniſhed lodgings, to which he may be driven immediately, without being under the neceſſity of lying in an execrable inn, where he muſt pay four livres a head for every meal, and ſix livres a day for an apartment.

MONTREAL, an iſland of North America, in the river St Laurence, about ſix leagues and a half in length, and three leagues over in the broadeſt parts. It belonged to the French; but was taken by the generals Amherſt and Murray on the 8th of September 1760, without firing a gun. According to the terms of capitulation, all the French forces were to be ſent to Old France; and conſequently all Canada became ſubject to the crown of Great Britain; which ceſſion was confirmed by the peace of 1763. The ſoil of the iſland is exceedingly rich and good, producing all kinds of European fruits and vegetables in great abundance, with variety of garden fruits. The ſouth ſide is the moſt inhabited, of courſe beſt cultivated; and beſides the ſettlements, which are numerous, the iſland is adorned with villas, for the retirement of the more wealthy merchants during the ſummer ſeaſon. No Indians are ſettled here; nor are they fond of ſettling on iſlands, from an hereditary diſtruſt leſt they ſhould be cut off by the Europeans. Since this place has been in the poſſeſſion of Britain, it has ſuffered much by fires, the houſes being moſtly built of wood.

The town of MONTREAL, ſituated on this iſland, and formerly called *Ville Marie*, is the ſecond place in Canada for extent, buildings, and ſtrength; and beſides poſſeſſing the advantage of a leſs rigorous climate, for delightfulneſs of ſituation is infinitely preferable to Quebec. It ſtands on the ſide of a hill, ſloping down to the ſouth, with many agreeable villas upon it, which, with the iſland of St Helen, and the river (which is here about two miles broad), form a moſt charming landſcape. Though the city is not very broad from north to ſouth, it covers a great length of ground from eaſt to weſt, and is nearly as large and populous as Quebec. The ſtreets are regular, forming an oblong ſquare; the houſes well built, and in particular the public edifices, which far exceed thoſe of the capital in beauty and commodiouſneſs; the reſidence of the knights hoſpitallers being extremely magnificent.—There are ſeveral gardens within the walls, in which, however, the proprietors have conſulted uſe more than elegance, particularly thoſe of the Siſters of the Congregation, the Nunnery Hoſpital, the Recollets, Jeſuits Seminary, and Governor. Beſides theſe, there are many other gardens and beautiful plantations without the gates, as the garden of the General Hoſpital, and the improvements of Mr Liniere, which exceed all the reſt, and are at an agreeable diſtance on the north ſide of the town. The three churches and religious houſes are plain, and contain no paintings, nor any thing remarkably curious, but carry the appearance of the utmoſt neatneſs and ſimplicity. The city has ſix or ſeven gates, large and ſmall; but its fortifications are mean and inconſiderable, being encompaſſed by a ſlight wall of maſonry, ſufficient only to overawe or prevent a ſurpriſe from the numerous tribes of Indians with whom they are ſurrounded, and who uſed to reſort in vaſt bodies to the annual fair held here, which continued from the beginning of June till the latter end of Auguſt, when many ſolemnities were obſerved, at which the governor aſſiſted, and guards were placed to preſerve good order among ſuch a concourſe of different ſavage nations, all of whom are extremely fond of ſpirituous liquors, and when drunk commit great exceſſes. The fortifications were by no means capable of ſuſtaining a regular attack; and though the garriſon in 1760 conſiſted of eight battalions of regular troops, a numerous militia, and a great body of ſavages, M Vaudreuil and Chevalier de Levis ſubmitted without firing a gun. There are no guns mounted on the wall; only a dry ditch ſurrounds it, about ſeven feet deep, encompaſſed with a regular glacis. On the inſide of the town is a cavalier on an artificial eminence, with a parapet of logs or ſquared timbers and ſix or eight guns, called the citadel. Such is the ſtrength of Montreal, the number of whoſe inhabitants may be between 5000 and 6000, extremely gay and well dreſſed. By the ſituation of the place, the inhabitants are well ſupplied with all kinds of river fiſh, ſome of which are unknown to Europeans, being peculiar to the lakes and rivers of this country. They have likewiſe plenty of black cattle, horſes, hogs, and poultry. The neighbouring ſhores ſupply them with a great variety of game in the different ſeaſons; and the iſland abounds with well taſted ſoft ſprings, which form a multitude of pleaſant rivulets. The city now drives a conſiderable trade in furs, &c. and veſſels of 200 tons can come up to it. It ſtands 60 leagues above Quebec.

MONTREAL, a town of Spain, in the kingdom of Arragon, with a caſtle, ſeated on the river Xiloca, 25 miles N. W. of Tervil, and 40 S. E. of Calataud.—W. Lon. 1. 2. N. Lat. 41. 9.

MONTREAL, a town of Italy, in Sicily, and in the valley of Mazara, with an archbiſhop's ſee; ſeated on a rivulet, five miles W. of Palermo, and 50 N. E. of Mazara. E. Lon. 13. 31. N. Lat. 38. 14.

MONTREAL, or *Mount Royal*, a fortreſs of Germany, in the circle of the Lower Rhine, and electorate of Triers; ſeated on the river Moſelle, 22 miles N. E. of Triers. E. Lon. 7. 6. N. Lat. 49. 59.

MONTROSE, a handſome town of North Britain, in the ſhire of Angus, ſituated at the mouth of the river Eſk, on the German Ocean, 46 miles north-eaſt of Edinburgh, but 70 miles diſtance by road. The houſes are neat, and many of them in the modern taſte. The moſt remarkable public buildings are, the town-houſe, the church, and an elegant epiſcopal chapel.—Montroſe is a parliament town, and a dukedom in the family of Graham. It ſtands between two rivers, the ſouth and north Eſks, over which there have been lately built two very handſome bridges, at a great expence. The ſalmon fiſheries on theſe rivers are very valuable, and form a good branch of commerce.

rose, merce. The harbour is a fine femicircular bafon defended by a handfome ftone pier. A great number of trading veffels belong to this port.

Montrose (Marquis of). See Graham; and Britain, n° 137, 138, 143, 265.

MONTSERRAT, a mountain of Spain, in Catalonia, one of the moft fingular in the world for fituation, fhape, and compofition. It ftands fingle, towering over a hilly country like a pile of grotto work or Gothic fpires; and its height fo great, that to a beholder on the top the neighbouring mountains appear to be funk to a level with the plain. It is compofed of fteep rocks, which at a diftance feem indented; whence it is faid to have received the name *Montferrat* from the Latin word *ferra* a "faw." It is impoffible to defcribe the beauty, richnefs, and variety, of the landfcapes difcovered from the moft elevated point: but the extenfivenefs of the profpect may be conceived by the reader, upon being told that the iflands of Minorca and Majorca, which are at the diftance of 60 leagues, are difcovered from this elevation.

Montferrat is particularly famous for the adoration that is paid to an image of the Virgin, which, according to tradition, was found in a cave in this mountain by fome fhepherds in the year 880. Over this image, Guthred earl of Barcelona caufed a monaftery and chapel to be erected; but, after remaining in this receptacle upwards of 700 years, Philip II. and Philip III. built a magnificent church for its reception. Innumerable and aftonifhing miracles are afcribed to this holy image. The convent or monaftery is fituated in a nook of the mountain; it feems as if vaft torrents of water, or fome violent convulfion of nature, had fplit the eaftern face of Montferrat, and formed in the cleft a fufficient platform to build the monaftery upon. The river Llobregat roars at the bottom, and perpendicular walls of rock, of prodigious height, rife from the water edge near half way up the mountain. Upon thefe maffes of white ftone refts the fmall piece of level ground which the monks inhabit. Clofe behind the abbey, and in fome parts impending over it, huge cliffs fhoot up in a femicircle to a ftupendous elevation: their fummits are fplit into fharp cones, pillars, pipes, and other odd fhapes, blanched and bare; but the interftices are filled up with forefts of evergreen and deciduous trees and plants. Fifteen hermitages are placed among the woods; nay, fome of them on the very pinnacles of the rocks, and in cavities hewn out of the loftieft of thefe pyramids.

The monaftery is one of the 45 religious houfes of the Spanifh congregation of the order of St Benedict; their general chapter is held every fourth year at Valladolid, where the deputies choofe abbots and other dignitaries for the enfuing quadrennium. In this monaftery, they elect for abbot a Catalan and a Caftilian alternately. Their poffeffions are great, confifting of nine villages lying to the fouth of the mountain; but the king has lately curtailed their income about 6000 livres a year, by appropriating to his own ufe the beft houfe in each village, fome of which, with their tythes, are worth 200 dollars per annum. Their original foundation, in 866, gave them nothing but the mountain; and to donations and economy they owe the great increafe of their landed property. They are bound to feed and harbour for three days all poor pilgrims that come up to pay their homage to the Virgin; and the allowance is a luncheon of bread in the morning, as much more, with broth, at noon, and bread again at night. Sometimes, on particular feftivals, 7000 perfons arrive in one day; but people of condition pay a reafonable price for what they eat.—The number of profeffed monks, according to Mr Swinburne, is 76 (according to M. Bourgoanne 60); of lay-brothers, 28; and of finging boys, 25; befides phyfician, furgeon, and fervants. The church is a gloomy edifice; and the gilding is much fullied with the fmoke of 85 lamps of filver, of various forms and fizes, that hang round the cornice of the fanctuary. Funds have been bequeathed by different devotees for furnifhing them with oil. The choir above ftairs is decorated with the life of Chrift, in good wooden carving. A gallery runs on each fide of the chancel, for the convenience of the monks. A large iron grate divides the church from the chapel of the Virgin, where the image ftands in a nich over the altar, before which burn four tapers in large filver candlefticks, the prefent of the duke of Medina Celi. In the facrifty, and paffages leading to it, are preffes and cupboards full of relics and ornaments of gold, filver, and precious ftones; they point out, as the moft remarkable, two crowns for the Virgin and her fon, of ineftimable value; fome large diamond rings; an excellent cameo of Medufa's head; the Roman emperors in alabafter; and the fword of St Ignatius. But as no offerings to this miraculous ftatue can be rejected or otherwife difpofed of, the fhelves are crowded with moft whimfical *ex votos*, viz. filver legs, fingers, breafts, ear rings, watches, two-wheeled chaifes, boats, carts, and fuch like trumpery.

Montferrat.

On different parts of the mountain, as already noticed, are a number of hermitages. Each of thefe folitary retreats, which at a diftance feem deftitute of every thing, has a chapel, a cell, a well in the rock, and a little garden. The inhabitant of one of them, which is dedicated to St Beneto, has the privilege of making an annual entertainment on a certain day; on which day all the other hermits are invited, when they receive the facrament from the hands of the mountain vicar, and after divine fervice dine together. They meet alfo at this hermitage, on the days of the faints to which their feveral hermitages are dedicated, to fay mafs, and commune with each other. But at other times they live in a very folitary and reclufe manner, perform various penances, and adhere to very rigid rules of abftinence; nor do they ever eat flefh; nor are they allowed to keep within their walls either dog, cat, bird, or any living thing, left their attention fhould be withdrawn from heavenly to earthly affections. Moft of thefe hermits are faid to be perfons of fortune and family, difgufted with the world, who have retired thither to devote themfelves to meditation, felf-denial, and contrition.

Montserrat, one of the Caribbee Ifles belonging to Great Britain. It is a very fmall, but very pleafant ifland, fo called by Columbus from its refemblance to the famous mountain near Barcelona in Catalonia. It lies in W. Long. 61. 0. N. Lat 16. 50. having Antigua to the north-eaft, St Chriftopher's and Nevis to

to the north-weft, and Gaudaloupe lying fouth fouth-eaft at the diftance of about nine leagues. In its figure it is nearly round, about nine miles in extent every way, 27 in circumference, and is fuppofed to contain about 40,000 or 50,000 acres. The climate is warm, but lefs fo than in Antigua, and is efteemed very healthy. The foil is mountainous, but with pleafant valleys, rich and fertile, between them; the hills are covered with cedars and other fine trees. Here are all the animals as well as vegetables and fruits that are to be found in the other iflands, and not at all inferior to them in quality. The inhabitants raifed formerly a confiderable quantity of indigo, which was none of the beft, but which they cut four times a-year. The prefent product is cotton, rum, and fugar. There is no good harbour, but three tolerable roads, at Plymouth, Old Harbour, and Ker's bay, where they fhip the produce of the ifland. Public affairs are adminiftered here as in the other ifles, by a lieutenant-governor, council, and affembly, compofed of no more than eight members, two from each of the four diftricts into which it is divided. The wonderful effects of induftry and experience in meliorating the gifts of nature have been no where more confpicuous than in thefe iflands, and particularly in this, by gradually improving their produce, more efpecially of late years, fince the art of planting hath been reduced to a regular fyftem, and almoft all the defects of foil fo thoroughly removed by proper management and manure, that, except from the failure of feafons, or the want of hands, there is feldom any fear of a crop. In 1770 there were exported from this ifland to Great Britain 167 bags of cotton, 1670 l.; 740 hogfheads of rum, 7400 l. To Ireland 133 ditto, 1330 l.; 4338 hogfheads 232 tierces 202 barrels of fugar, 79,507 l.; in the whole 89,907 l. To North America 17,633 l. There are a few fhips employed in trading to this ifland from London and from Briftol. As to the number of inhabitants, according to the moft probable accounts, they confift of between 1200 and 1500 whites, and from 10,000 to 12,000 negroes, tho' fome fay not fo many.

MONUMENT, in architecture, a building deftined to preferve the memory, &c. of the perfon who raifed it, or the perfon for whom it was raifed; fuch are a maufoleum, a triumphal arch, a pyramid, &c.

MOOD, or MODE. See MODE.

MOODS of Syllogifm. See Logic n° 85.

MOOD, or *Mode*, in grammar, the different manner of conjugating verbs. See GRAMMAR.

MOON, (*Luna*, ☽), in aftronomy, one of the heavenly bodies, ufually ranked among the planets; but with more propriety accounted a fatellite, or fecondary planet.

Among the ancients, the moon was an object of prime regard.—By the *Hebrews* fhe was more regarded than the fun, and they were more inclined to worfhip her as a deity. The new moons, or firft days of every month, were kept as feftivals among them, which were celebrated with found of trumpets, entertainments, and facrifice. (See Numb. xxviii. 11. x. 16. 1 Sam. xx. 5—18.) People were not obliged on thefe days to reft. The feafts of new moons were a miniature reprefentation of the feaft of trumpets, which was held on the firft of the month Tifri, which was the beginning of the civil year. The Jews not being acquainted with the phyfical caufe of eclipfes, looked upon them, whether of fun or moon, as figns of the divine difpleafure. The Grecians looked upon the moon as favourable to marriage; and the full moons or the times of conjunction of fun and moon, were held the moft lucky feafons for celebrating marriages; becaufe they imagined the moon to have great influence over generation. The full moon was held favourable for any undertakings by the Spartans: And no motive could induce them to enter upon an expedition, march an army, or attack an enemy, till the full of the moon. The moon was fuppofed both by Greeks and Romans to prefide over child-birth.—The patricians at Rome wore a crefcent on their fhoes, to diftinguifh them from the other orders of men. This crefcent was called *Lunula*. Some fay it was of ivory, others that it was worked upon the fhoe, and others that it was only a particular kind of fibula or buckle.

As all the other planets move primarily round the fun, fo does the moon round the earth: her orbit is an ellipfis, in which fhe is retained by the force of gravity; performing her revolution round the earth, from change to change, in 29 days, 12 hours, and 44 minutes, and round the fun with it every year: fhe goes round her orbit in 27 days, 7 hours, 43 minutes, moving about 2290 miles every hour; and turns round her axis exactly in the time that fhe goes round the earth, which is the reafon of her keeping always the fame fide towards us; and that her day and night taken together are as long as our lunar month.

The mean diftance of the moon from the earth is $60\frac{1}{2}$ femi-diameters of the earth; which is equivalent to 240,000 miles. The mean eccentricity of her orbit is $\frac{55}{1000}$ of her mean diftance, or in miles 13,000, which makes a confiderable variation in that mean diftance. —Her diameter is to that of the earth as 100 to 365, as 11 to 40.15, or 2180 miles: its mean apparent diameter is 31 minutes $16\frac{1}{2}$, and that of the fun 332 minutes 12 feconds. Its mean diameter, as feen from the fun, is 6 feconds.

The moon's furface contains 14,898,750 fquare miles, and its folidity 5,408,246,000 cubical ones. The denfity of the moon's body is to that of the earth as 48,911 to 39,214; to that of the fun, as 48,911 to 10,000; its quantity of matter to that of the earth, nearly as 1 to 39.15; the force of gravity on its furface is to that on the furface of the earth as 139.2 to 407.8; and the moon's bulk to that of the earth as $\frac{1}{50}$ to 1. The moon has fcarce any difference of feafons; becaufe her axis is almoft perpendicular to the ecliptic.

The different appearances of the moon are very numerous; fometimes fhe is increafing, then waning; fometimes horned, then femicircular; fometimes gibbous, then full and round. Sometimes, again, fhe illumines us the whole night; fometimes only a part of it; fometimes fhe is found in the fouthern hemifphere, fometimes in the northern; all which variations having been firft obferved by Endymion, an ancient Grecian who watched her motions, fhe was fabled to have fallen in love with him. The fource of moft of thefe appearances is, that the moon is a dark, opaque, and fpherical body, and only fhines with the light fhe receives from the fun; whence only that half

turned towards him, at any inſtant, can be illuminated, the oppoſite half remaining in its native darkneſs. The face of the moon viſible on our earth, is that part of her body turned towards the earth; whence, according to the various poſitions of the moon, with regard to the ſun and earth, we obſerve different degrees of illumination; ſometimes a large and ſometimes a leſs portion of the enlightened ſurface being viſible.—But for a particular account of the nature, pheaomena, &c. of this ſecondary but intereſting planet, ſee ASTRONOMY-*Index*, at *Moon*.

New Obſervations on the Atmoſphere, Twilight, &c. of the Moon. M. Schroeter of the Royal Society of Gottingen has lately publiſhed a very curious and elaborate work in German, intitled *Selenotopographiſche Fragmente*, &c. or Selenotopographical Fragments, intended to promote a more accurate knowledge of the Moon's ſurface. The ſeveral maps of the moon *, which have been delineated by Hevelius, Ricciolus, Caſſini, and Mayer, are well known to every perſon converſant with aſtronomical ſubjects. It is evident that theſe delineations can give only a very general idea of the ſpots, together with their relative poſition on the lunar diſk; and as, with reſpect to us, the appearance of theſe muſt vary according to the direction in which the rays of the ſun fall on them, the moon's ſurface will not exactly correſpond with the repreſentation of it laid down in the map, except when it happens to be illuminated under the ſame angle as when this map was drawn. This conſideration induced the author to apply himſelf to the invention of a more accurate mode of deſcribing theſe phenomena than had hitherto been attempted. For this purpoſe, having provided himſelf with a teleſcope ſeven feet in length, conſtructed by Dr Herſchel, he reſolved, repeatedly, and under various angles of illumination, to obſerve and delineate very ſmall portions of the lunar diſk; in order that, by comparing his different drawings of the ſame objects, he might compile an accurate topographical deſcription of the moon's ſurface: but, in this manner, to form a complete lunar atlas, was an undertaking too extenſive for a ſingle perſon. He therefore found himſelf obliged to preſcribe more narrow limits to his deſign, and confined his plan to the delineation of the ſeveral portions of the moon's ſurface under one angle only of illumination, and this a very ſmall one, that he might obtain more diſtinct and accurate obſervations and drawings of the ſhadows; intending at the ſame time to examine ſuch parts as appeared either more remarkable or leſs diſtinct than the reſt, by repeated obſervations under various angles of illumination: And the preſent volume contains the reſult of his obſervations, with reſpect to the northern parts of the lunar diſk.

* A- NO- ndex, on.

The author obſerves, that, through a teleſcope which magnifies a thouſand times, a lunar object of 190 feet in ſurface appears like a very ſmall point; and that, to be diſtinguiſhable with reſpect to ſhape, it muſt not be leſs than 800 feet in extent. He tells us, that for his obſervations he preferred thoſe times when the ſun's rays fell on the moon under the leaſt angle; that he carefully and repeatedly examined every object that could be diſtinguiſhed, and either actually meaſured its apparent diameter and the length of its ſhadow, or compared theſe dimenſions with others which he had already meaſured; and that he never uſed magnifiers of greater power than what was abſolutely neceſſary to render the object diſtinct. In order to facilitate the delineation, he applied to his teleſcope a projecting micrometer, divided into ſmall ſquares, which, by means of a braſs rod, could be placed at any diſtance from the eye, and always be kept parallel to the line of the moon's horns. His maps or drawings are orthographical projections; and his ſcale is ſo conſtructed, that 20 ſeconds of the moon's diſk correſpond with half an Engliſh inch on the map; thus the ſpace of 4 ſeconds is repreſented in the compaſs of a decimal line, and, according to M. Schroeter's computation, anſwers to a German mile or 3807 toiſes. The inconveniences and inaccuracy of the common method of meaſuring the lunar mountains, induced him to contrive others capable of greater exactneſs and more general application: theſe he varied as the circumſtances of the caſe required; but they are all trigonometical calculations of the height of the mountain, or the depth of the cavity from the angle of illumination and from the length of the ſhadow.

If, as ſome have ſuppoſed, a great part of the moon's ſurface be volcanic, it is natural to expect that the marks of eruptions ſhould from time to time be diſcernible. A ſingle inſtance of this kind occurred to our author: ever ſince the 27th of Auguſt 1788, he had conſtantly ſeen a cavity, or, as he terms it, a *volcanic crater*, in the ſpot Hevelius, which he had never before perceived, though he had often examined this part of the moon with the utmoſt attention, and in the moſt favourable circumſtances. According to his conjectures, this phenomenon muſt have commenced between the 24th of October 1787 and the 27th of Auguſt 1788.

He obſerved ſome alterations in the appearance of lunar objects, which, though too conſiderable to be attributed to the variation of light, were not ſufficiently permanent to be conſidered as the effect of volcanoes. Theſe he aſcribes to meteors; for though he does not ſuppoſe the moon to be ſurrounded with air, exactly like that which inveſts our globe, he thinks it probable that it may have an atmoſphere of ſome kind, in which ſome of the elements of bodies, decompounded on its ſurface, may be ſuſpended; and that ſome of the lunar mountains may emit nebulous vapours, not unlike the ſmoke of our volcanoes, which obſcure and diſguiſe the objects ſeen through them.

In regard to thoſe bright points, which have been ſeen on the moon's ſurface during eclipſes, and at other times on her unenlightened part, and which ſome have ſuppoſed to be burning volcanoes; Schroeter, after the moſt attentive examination of them, imagines that moſt of them muſt be aſcribed to the light reflected from the earth to the dark part of the moon's diſk, which returns it from the tops of its mountains, under various angles, and with different degrees of brightneſs. Some of theſe phenomena he ſuſpects to be no more than optical illuſions, ariſing from igneous meteors floating in our atmoſphere, which happen to fall within the field of the teleſcope.

But the moſt intereſting part of this work conſiſts of the author's "Remarks on the Formation and phyſical Conſtitution of the Moon's Surface and Atmoſphere."

The

Moon.

The ſurface of the moon appears to be much more unequal than that of our earth; and theſe inequalities have great variety both in form and magnitude. There are large irregular plains, on which are obſerved long and narrow ſtrata of hills running in a ſerpentine direction: ſome of the mountains form extenſive chains; others, which are in general the higheſt, ſtand alone, and are of a conical ſhape: ſome have craters; others form a circular ring incloſing a plain; and in the centre of many of theſe plains, as well as in the middle of ſome of the craters, other mountains are found, which have likewiſe their craters. Theſe mountains are various with reſpect to colour, ſome being much darker than others.

The moſt lofty mountain on the ſurface of our globe is ſuppoſed to be Chimboraco, which is not 20,000 feet in height: but there are many in the moon which are much higher; that which is diſtinguiſhed by the name of *Leibnitz*, is not leſs than 25,000 feet. This elevation will appear more extraordinary, if compared with the moon's diameter, of which it is $\frac{1}{214}$th; whereas Chimboraco is not above $\frac{1}{1017}$th of that of the earth: thus conſidered, the lunar mountains are near five times as high as any on our globe.

The craters of the moon are circular, and ſurrounded with an annular bank of hills: they are remarkable for their width, many of them being from 4 to 15 geographical miles in diameter: ſome are not deeper than the level of the moon's ſurface; others are 9000, 12,000, and 15,000 feet in depth: that of one, which our author calls *Bernouilli*, is above 18,000 feet. The height of the annular bank is ſeldom equal to the depth of the crater which it ſurrounds; but the quantity of matter in the one appears to be in general nearly equal to the capacity of the other. The principal mountains and cavities ſeem to be connected by a ſeries of others of leſs magnitude; and ſometimes by hilly ſtrata, which, like the radii of a circle, may be traced to a common centre; this is generally either a mountain or crater, though not of the greateſt height or depth. Theſe hilly ſtrata, which, through ſmaller teleſcopes, appear like veins on the moon's ſurface, have often been miſtaken for torrents of lava; none of which, M. Schroeter ſays, he could ever diſcover.

From all the preceding circumſtances, the author concludes, that whatever may have been the cauſe of the inequalities of the moon's ſurface, it muſt not only have operated with great violence, but alſo have met with great reſiſtance; which inclines him to think, that the ſubſtance of this planet muſt originally have been very hard and refractory. He is of opinion that theſe mountains and cavities muſt have been produced in conſequence of ſome great revolution occaſioned by the action of a force directed from the centre towards the ſurface, and in this reſpect ſimilar to that which gave birth to our volcanoes: but he obſerves, that we have no reaſon to ſuppoſe it abſolutely volcanic, nor that it originated from fire. In ſome places, this force has only elevated the ſurface, and thus formed hills and mountains; in others, the ground has yielded to its violence, and has either been thrown up as a bank round the crater thus formed, or elſe falling into other cavities, has in part filled them up; after having exerted its greateſt violence in theſe mountainous accumulations, it has diffuſed itſelf in various directions, and produced the hilly ſtrata which are obſerved to diverge from them, like the radii of a circle from the centre. In ſupport of this hypotheſis, it is alleged, that the largeſt craters have the leaſt depth, and that in the deepeſt there is the moſt equal proportion between the capacity of the crater and the volume of the annular bank around it: but beſide the grand revolution here ſuppoſed, M. Schroeter is of opinion that there have been others of later date and leſs extent; to theſe he aſcribes the formation of ſecondary mountains, which ariſe either from the middle of the craters of the primary, or from the centre of a plain ſurrounded by a circle of hills; many of theſe have alſo craters, and, like the primary mountains, are connected by a ſeries of cavities and hilly ſtrata, that mark the progreſs of the cauſe by which they were produced. The new crater diſcovered by our author in the ſpot Hevelius, together with other circumſtances here enumerated, ſeem to indicate that the ſurface of the moon is far from being permanently ſettled and quieſcent.

The author's obſervations confirm the opinion that the cavities viſible on the lunar ſurface do not contain water: hence he concludes, that there can be no extenſive ſeas and oceans, like thoſe which cover a great part of the earth; but he allows that there may be ſprings and ſmall rivers. The queſtion, whether the moon be inhabited? is not omitted by M. Schroeter, who obſerves, that though it be not adapted to beings organiſed as we are, this is no proof that it may not be peopled with intelligent agents, endued with bodily conſtitutions ſuitable to the nature and economy of the planet for which they are deſtined.

With regard to a lunar atmoſphere, the exiſtence of which has been a ſubject of much diſpute *, our author adduces a variety of proofs in ſupport of the affirmative ſide of the queſtion. He alſo makes a number of obſervations on ſeveral of its relative properties, compared with the ſame in our atmoſphere; ſuch as its greater dryneſs, rarity, and clearneſs, which, however, do not prevent its refracting the ſolar rays; having pointed out the circumſtance, that the mountains in the dark hemiſphere of the moon, near its luminous border, which are of ſufficient height to receive the light of the ſun, are the more feebly illuminated the more diſtant they are from that border: from which proofs of a refracting atmoſphere, he alſo deduced the probability of the exiſtence of a faint twilight, though his long ſeries of obſervations had not yet fully evinced it.—He had, however, aſcertained the exiſtence of a twilight on Venus; and as one fortunate diſcovery often leads to another, he had no ſooner ſucceeded in his obſervations on that planet, than he was induced to direct his attention, for a ſimilar purpoſe, to the moon. In doing this, he applied the calculations and inferences he there made to ſome appearances he had already noticed on this ſatellite. It occurred to him, that if in fact there were a twilight on the moon, as there is on Venus and our earth, it could not, conſidering the greater rarity of its atmoſphere, be ſo conſiderable: that the veſtiges of it, allowing for the brightneſs of the luminous part of the moon, the ſtrong light that is thence thrown upon the field of the teleſcope, and in ſome meaſure the reflected light of our earth, could only be traced on the limb, particularly

* See ASTRONOMY-Index at Moon.

cularly at the cusps; and even this only at the time when our own twilight is not strong, but the air very clear, and when the moon, in one of its least phases, is in a high altitude, either in the spring, following the sun two days after a new moon; or in the autumn, preceding the sun in the morning, with the same aspect: in a word, that the projection of this twilight will be the greater and more perceptible the more falcated the phase, and the higher the moon above the horizon, and out of our own twilight.

All the requisite circumstances do not often coincide. M. Schroeter, however, was so fortunate as to be favoured with a combination of them on the 24th of February 1792: And the observation proved in every respect so complete, and the inferences deducible from it appeared to him so new and interesting, that he could not with-hold the immediate communication of it from the public. His observations concerning both the Moon and Venus have been accordingly detailed in a paper sent to the Royal Society of London, and inserted in their Transactions for 1792; from which the following respecting the Moon are extracted.

"On the above mentioned evening, at $5^h\ 40'$, two days and 12 hours after the new moon, when in consequence of the libration the western border of the grey surface of the Mare Crisium was $1'\ 20''$ distant from the western limb of the moon, the air being perfectly clear, I prepared my seven-feet reflector, magnifying 74 times, in order to observe the first clearing up of the dark hemisphere, which was illuminated only by the light of our earth, and more especially to ascertain whether in fact this hemisphere, which, as is well known, is always somewhat more luminous at the limb than in the middle, would emerge out of our twilight at many parts at once, or first only at the two cusps. Both these points appeared now, most distinctly and decidedly, tapering in a very sharp, faint, scarce any where interrupted, prolongation; each of them exhibiting, with the greatest precision, its farthest extremity faintly illuminated by the solar rays, before any part of the dark hemisphere could be distinguished. But this dark hemisphere began soon after to clear up at once at its border, though immediately only at the cusps, where, but more particularly at their points, this border displayed, on both at the same time, a luminous margin, above a minute in breadth, of a very pale grey light, which, compared with that of the farthest extremities of the cusps themselves, was of a very different colour, and relatively as faint as the twilight I discovered on the dark hemisphere of Venus, and that of our own earth, when compared with the light immediately derived from the sun. This light, however, faded away so gradually towards the east, as to render the border on that side perfectly undefined, the termination losing itself imperceptibly in the colour of the sky.

"I examined this light with all possible care, and found it of the same extent at both points, and fading away at both in the same gradual proportion. But I also, with the same caution, explored whether I could distinguish any part of the limb of the moon farther towards the east; since, if this crepuscular light had been the effect of the light reflected from our globe, it would undoubtedly have appeared more sensibly at the parts most remote from the glare of the illuminated hemisphere. But, with the greatest exertion of my visual powers, I could not discover any part of the, as yet, wholly darkened hemisphere, except one single speck, being the summit of the mountainous ridge Leibnitz, which was then strongly illuminated by the solar light: and indeed eight minutes elapsed before the remainder of the limb became visible; when not only separate parts of it, but the whole, displayed itself at once.

Moon.

"This alone gave me certain hopes of an ample recompence, and satisfied me that the principles I had laid down in my Selenotop. Fragm. § 525. *et seq.* concerning the atmospheres of the planets, and especially of the moon, are founded on truth. But a similar observation made on the 6th, after seven o'clock, afforded me several collateral circumstances, which strongly corroborate what I have there advanced on this subject. The whole limb of the dark hemisphere, illuminated only by the reflected light of our globe, appeared now so clear and distinct, that I could very readily discern not only the large but also the smaller spots, and among these Plato, Aristarchus, Menelaus, Manilius, Copernicus, &c. and even the small speck to the north-west of Aristarchus, marked *b*, Tab. XXVII. fig. 1. of the Fragments. I could apply the usual power, magnifying 161 times; and had full leisure, and the means, to examine every thing carefully and repeatedly, and to take very accurate measurements.

"Although a just idea of so delicate a phenomenon as this crepuscular light cannot possibly be conveyed by a drawing, but must be gathered from actual inspection, I have, nevertheless, attempted a delineation of it, and of the southern and eastern cusps, fig. 1, and 2. as deduced from my measurements, especially at the southern cusp, in hopes thereby to render what I have farther to say concerning this observation the more intelligible. Plate CCCXIV.

"The southern cusp (fig. 1.) extended from *a* to *c*, with a gradually fading but still resplendent solar light, of its usual pale yellow colour, and terminated at *c* with a mountain. That this was really the point of the cusp, appears not only from the general construction of the falcated segment, which was sufficiently narrow even at its beginning *a*, near which it was somewhat disfigured at *b* by a high mountain, but also from the narrowness of its luminous curve at *de* and *f*, the breadth of which seldom exceeded $1''$, and had a sensible interruption so near as *d*. This curve was throughout, from *a* to *c*, except where the glare of the solar rays spread some degree of light, bordered with the pale ash-colour of the dark hemisphere, glimmering with the faint light reflected from our earth; out of which, however, rose the higher mountains *g*, *h*, *i*, *c*, which were now already illuminated by the sun; and farther on, not less than 30 lines, or, according to my usual projection, two minutes distant from the point *c*, was seen another mountain *l*, which belonged to the high ridge Leibnitz, and also received its light immediately from the sun.

"There can hence be no doubt of the termination of the cusp being at *c*; and this being well ascertained, I now distinguished with the greatest certainty the twilight extending from *c* to *k*. The most remarkable circumstances attending this light were, that it was

Moon. was broadeſt and brighteſt at c, and that it dwindled away and contracted towards k, where it loſt itſelf in the faint glimmering of our terreſtrial light; and that at the northern cuſp (fig. 2.), at which there do not appear to be ſo many mountains and inequalities as at the ſouthern, this light exhibited the ſame pyramidal form, and was of equal length, and alike fading in intenſity and colour, as that at the ſouthern.

"This light, compared with that of the thinneſt and leaſt bright part of the cuſp dc, was as faint as the pale aſh coloured ſpots in the luminous hemiſphere, when oppoſed to the bright ones. But this is ſtill better illuſtrated by a compariſon between the high mountain l (fig. 1.) which now already appeared illuminated by the ſolar light and the ſpot Ariſtarchus, which ſhone moderately merely with the light reflected from our globe. The ſaid mountain had, comparatively with the thin luminous arc def of the bright hemiſphere, and the mountains g, h, i, c, a very pale, fading, but yet brighter light than Ariſtarchus, as indeed might have been expected from what I ſaid in my Selenotop. Fragm.; but this reflected light upon Ariſtarchus was, however, ſenſibly brighter than the glimmering light from c to k. And, reſpecting the ſtill fainter terreſtrial light which bordered the luminous curve from c to k (fig. 1. and 2.), I cannot give a better idea of it than by obſerving, that the light at the extremities of both the cuſps appeared of a pyramidal form, ſimilar to, but though gradually fading, and very undefined, yet brighter than that of our zodiacal light, when, in the months of March and April, it blends itſelf, comparatively with the remaining colour of the ſky, with the terreſtrial light, terminating in a very ſharp point.

"The undefined and gradually fading appearance of this light was the cauſe that, though I had recourſe to a dark projection table, I could not, however, take any accurate meaſurements of it. I found nevertheleſs, by repeated compariſons, that the length of this pyramidal glimmering light, in which I could perceive no ſenſible inequality at the limb of the moon, amounted to about $\frac{2}{3}$ of the diſtance between the two mountains c, l, (fig. 1.) which ſhone with the ſolar light. Comparing alſo this ſouthern twilight with the northern, it appeared of the ſame length; and, on meaſuring the diſtance cl, I found it repeatedly $= 30$ lines $= 2'$; ſo that the length of the twilight muſt have amounted to 20 lines $= 1' 20''$. Its greateſt breadth at c could, on the other hand, becauſe of the extent and greater denſity of its light, be eaſily aſcertained by means of the immediate application of the projection table. This meaſurement gave at moſt $\frac{2}{3}$ of a line, or full $2''$.

"Although I be poſitively certain of this very remarkable appearance at both cuſps, and of its perfect ſimilarity, in all my obſervations, I could not, however, trace any veſtige of a like crepuſcular light at any other part of the terminating border: nor could I on the very next evening, being the 25th, and alſo on the 26th of February, perceive, even at the cuſps, any of the twilight I expected to ſee there; the very thin, faint, luminous line, which did indeed appear on the 26th, at the ſouthern cuſp between a and b, (fig. 3.), being undoubtedly the effect of the immediate ſolar light, probably illuminating ſome prominent, flat area, as yet ſituated in the dark hemiſphere.

"Thus far the obſervations: and now for the application of them.

"I need hardly inſiſt upon the proofs, that the very faint pyramidal glimmering light, obſerved on the 24th of February at the extremities of both cuſps, could by no means be the immediate effect of the ſolar light, all the circumſtances of the obſervations militating uniformly and decidedly againſt this ſuppoſition, which, were it true, would oblige us to admit a moſt unaccountable diminution of light, and thence alſo a denſity of the lunar atmoſphere, that ought to exceed even the denſity of ours; a fact abſolutely contradicted by all the lunar obſervations hitherto made. This light, indeed, was ſo very faint, that it diſappeared at $7^h 20'$, when the moon approached the horizon; whilſt, on the other hand, Ariſtarchus, which had no light but what it received from the earth, was ſtill very diſtinguiſhable; and the ſummit of Leibnitz l, fig. 1. (which, though far within the dark hemiſphere, was, however, illuminated by the immediate ſolar rays) diſplayed a degree of brightneſs, which, although when compared with that of the cuſp def, it appeared very faint and dwindling, equalled, however, that of our Peak of Teneriffe. Nor can it be conceived why this glimmering light broke off ſo ſuddenly at both the cuſps, without a progreſſive diminution. It can hardly be ſuppoſed, that ſimilar, grey, prominent, flat areas, of the ſame form and dimenſions, and comparatively of a faint light, which, whilſt in the dark hemiſphere, they derive immediately from the ſun, exiſt on all parts of the moon; more eſpecially as, at the places obſerved, the limb happened to exhibit throughout an exact ſpherical form, without the leaſt ſenſible inequality; and as in both the bordering regions of the northern and ſouthern hemiſpheres, eſpecially in the latter, no ſuch grey prominent planes are any where diſcernible. It may then be aſked, why did this faint glimmering light appear at both cuſps, along equal arcs of the limb, of equal length and breadth, and of the ſame pyramidal form? and why did its farther extremity blend itſelf with the terreſtrial light of the dark hemiſphere, which, acccording to a great number of my ſelenotopographic obſervations, is by no means the caſe, even with thoſe grey prominent areas, which, being at ſome diſtance on the dark ſide of the terminating border, are nevertheleſs illuminated immediately by the ſun?

"Theſe, therefore, could certainly not derive their light immediately from the ſun; whence this appearance, like the ſimilar ones on the planet Venus, can only be aſcribed to the ſolar rays reflected by the atmoſphere of the moon upon thoſe planes, producing on them a very faint, gradually diminiſhing, glimmering light, which at laſt loſes itſelf in the reflected terreſtrial light, in the ſame manner as our twilight blends itſelf with the light of the moon. Every circumſtance of the above obſervation ſeems to me to confirm this ſuppoſition; and hence the obſervation itſelf, which, though ſingle, was however a moſt fortunate and complete one, muſt appear of no ſmall degree of importance, ſince it not only confirms the obſervations and inferences on the long conteſted lunar atmo-

atmosphere contained in my Selenotop. Fragm. but also furnishes us with many more lights concerning the atmosphere of planets in general than had been afforded us by all those observations collectively."

This, and the mathematical certainty that the phenomenon is in fact nothing but a real twilight in the lunar atmosphere, he farther evinces by a series of theoretical deductions and calculations, which do not admit of being here stated. Among other results, it appears, that the lower and more dense part of the lunar atmosphere, that part, namely, which has the power of reflecting this bright crepuscular light, is only 1356 Paris feet in height; and hence it will easily be explained how, according to the different librations of the moon, ridges of mountains, even of a moderate height, situated at or near the terminating border, may partially interrupt, or at times wholly prevent, this crepuscular light, either at one or the other cusp, and sometimes at both. "I cannot hence (says our author) but consider the discovery I here announce as a very fortunate one, both as it appears to me decisive, and as it may induce future observers to direct their attention to this phenomenon. Admitting the validity of this new observation, which I think cannot well be called in question, I proceed now to deduce from it the following inferences.

"1. It confirms, to a degree of evidence, all the selenotopographic observations I have been so successful as to make on the various and alternate changes of particular parts of the lunar atmosphere. If the inferior and more dense part of this atmosphere be in fact of sufficient density to reflect a twilight over a zone of the dark hemisphere 2° 34′, or $10\frac{1}{4}$ geographical miles in breadth, which shall in intensity exceed the light reflected upon its dark hemisphere by the almost wholly illuminated disk of our earth; and if, by an incidental computation, this dense part be found to measure 1356 feet in perpendicular height, it may, according to the strictest analogy, be asserted, that the upper, and gradually more rarified strata, must, at least, reach above the highest mountains in the moon. And this will appear the more evident, if we reflect, that notwithstanding the inferior degree of gravitation on the surface of the moon, which Newton has estimated at somewhat less than one-sixth of that on our earth, the lower part of its atmosphere is nevertheless of so considerable a density. This considerable density will, therefore, fully account for the diminution of light observed at the cusps, and on the high ridges Leibnitz and Doerfel, when illuminated in the dark hemisphere; as also for the several obscurations and returning serenity, the eruptions, and other changes, I have frequently observed in the lunar atmosphere. This observation also implies:

"2. That the atmosphere of the moon is, notwithstanding this considerable density, much rarer than that of our earth. And this indeed is sufficiently confirmed by all our other lunar observations. I think I may assert, with the greatest confidence, that the clearer part of our twilight, when the sun is 4° below our horizon, and when we can conveniently read and write by the light we receive from it, surpasses considerably in intensity the light which the almost wholly illuminated disk of our earth reflects upon the dark hemisphere of the moon $2\frac{1}{2}$ days before and after the new moon. But should we even admit an equal degree of intensity, it will, however, appear from computation, that our inferior atmosphere, which reflects as strong a light over 4° as that of the moon does over 2° 34′ of their respective circumferences, must be at least eight times higher than that of the moon.

"3. The striking diminution of light I noticed in my twelve years observations on Venus, likewise indicates, that the atmosphere of that planet, which is in many respects similar to ours, is much denser than that of the moon; and this will be still farther corroborated, if we compare together the several measurements and computations made concerning the twilights of different planets. There is no doubt but that the faintest twilight of Venus, as seen either before or after the rising and setting of the sun across our twilight, is much brighter than that of the moon; and it appears, moreover, from computation, that the denser part of the atmosphere of Venus measures at least 15000 Paris feet in height, and spreads its twilight 67 geographical miles into the dark hemisphere, whilst the denser part of the lunar atmosphere, whose height does not exceed 1356 feet, produces a faint twilight not above $10\frac{1}{4}$ geographical miles in breadth. Thus, as my successful observations on the twilight of Venus led me to the discovery of that of the moon, so did these latter reciprocally confirm the former: and thus, whichever way we contemplate the subject, must we be struck with the coincidence that prevails throughout.

"4. But if the lunar atmosphere be comparatively so rare, it follows, that the inflection of light produced by it cannot be very considerable; and hence does the computation of M. du Sejour, according to which the inflection of the solar rays which touch the moon amounts to no more than $4\frac{1}{2}''$, receive an additional degree of authenticity *. Besides which,

"5. As the true extent of the brightest lunar twilight amounts to 2° 34′, the obliquity of the ecliptic in the moon only to 1° 29′; the inclination of the orbit of the moon, on the contrary, to 5° 15′, and its synodic period, during which it performs a revolution round its axis is $= 29^d\ 12^h$; it follows, that its brightest twilight, to where it loses itself in the light reflected by the almost fully illuminated disk of our earth, must, at least at its nodes, last $5^h\ 3'$, and that it will be still longer at other parts of the orbit, according to the situation of the nodes.

"6. And lastly, it being a well known fact † that the fixed stars, as they approach the moon, diminish in splendor at the most only a very few seconds before their occultations, it was natural for me, after the successful observations I had made on the twilight of the moon, to pay particular attention to this circumstance. On the 25th of February, at 6^h P. M. the sky being very clear, the limb of the dark part of the moon appeared uncommonly distinct; and only a few seconds of a degree from its edge was seen a telescopic star of about the 10th or 12th magnitude. I counted full 20″ before its occultation, and $18\frac{1}{2}$ of these, without the least perceptible diminution of light. The star, however, began now gradually to fade, and after the remaining $1\frac{1}{2}'$, during which I observed it with all possible attention, it vanished in an instant. This observation agrees perfectly with the above computations.

* *De la Lande's Astron.* § 1992—1994.

† *Selenot. Fragm.* § 531.

Moon. putations. Although it be proved that the inferior denſe part of the lunar atmoſphere reflects a ſtronger light than that which the dark hemiſphere receives from an almoſt fully illuminated diſk of our earth; and although, conſidering the inferiority of gravitation on the ſurface of the moon, there be no doubt that this denſe part, together with the ſuperior gradually more rarified regions of its atmoſphere, muſt extend far above its higheſt mountains; it is yet a fact, that the breadth of this obſerved twilight, to where it loſes itſelf in our reflected terreſtrial light, does not meaſure more than 2° 34′: it is therefore highly probable, that its greateſt extent, in the moſt favourable phaſes near our new moon, can never exceed the double of the above arc, or 5° 8′; and hence we can only infer a perpendicular height of an atmoſphere, capable of inflecting the ſolar rays, which at moſt meaſures 5376 feet: nor is it very likely that, unleſs accidental and hitherto unknown circumſtances ſhould occaſionally condenſe different parts of this atmoſphere, theſe upper ſtrata ſhould materially affect the diſtinctneſs of a ſtar ſeen through it.

"But admitting the height of the atmoſphere, which may affect the brightneſs of a fixed ſtar, not to be leſs than 5376 feet, this will amount to an arc of only 0,94″, or not quite one ſecond; and as the moon deſcribes an arc of 1″ in 2″ of time, it follows, that in general the fading of a ſtar, which approaches to an occultation, cannot laſt quite 2″ in time; that if the appulſe be at a part of a limb of the moon where a ridge of mountains interferes, the gradual obſcuration will laſt a ſhorter time; and that it may, under ſome circumſtances of this nature, be even inſtantaneous."

To the foregoing obſervations, M. Schroeter ſubjoins the following account of an occultation of Jupiter by the moon when near its full, which occurred to him by mere accident on the 7th of April 1792.

"The ſky being very ſerene, and Jupiter uncommonly bright, I prepared my ſeven-feet reflector, magnifying 74 times, in hopes that the ſtrong light and diſtinctneſs it afforded would enable me to compare the appearances of this phenomenon with the reſults which I had deduced from my late obſervations on the height and denſity of the atmoſphere of the moon.

Plate CCCXIV. "Fig. 4. repreſents the ſituation of Jupiter's four ſatellites, as they appeared, moſt diſtinctly, two of them to the weſtward, the ſecond about one, and the firſt near two of Jupiter's diameters diſtant from its limb; and the two others to the eaſtward, the third about ſeven and the fourth near eight of the ſame diameters, diſtant from the ſaid limb.

"Fig. 5. ſhows Jupiter with its belts, and of a ſomewhat ſpheroidical form, as it now appeared to me, and as diſtinctly as I had ever ſeen it. The equatorial belt, from *a* to *d*, was very apparent. It conſiſted properly of two zones, *a b* and *c d*, of a browniſh-grey colour, with a more luminous interval *b c* between them. At *e* and *f* were two comparatively well defined ſtripes, which I had noticed for many years back, but which now croſſed the whole diſk; and the polar regions appeared again, from *g* and *h*, more dim and grey than the bright part of the planet. But what particularly ſtruck me, were two nebulous undefined ſpots, *i* and *k*, which were ſenſibly darker than the principal zone *d d*; and at *l* a ſtill more remarkable, circular, tho' imperfectly defined ſpot, ſomewhat brighter than the luminous interval between the zones, and perfectly ſimilar to the remarkable luminous ſpot which I had obſerved in 1786 and 1787 on the ſame part of Jupiter, and which then led me to ſome very unexpected inferences concerning the atmoſphere of that planet *.

* Beyden neu. Aſtron. Entd.

"Theſe favourable circumſtances led me to the following accurate obſervation, which I was certain would prove inſtructive to me. At 10h 40′ 50″ I ſaw the ſpot *i* at about the middle of its parallel; and immediately after began the occultation; than which a more diſtinct and beautiful one was perhaps never ſeen. and T fig. 6.

"*Immerſions.* The weſtern, preceding, firſt ſatellite, diſappeared behind the ſharp bright limb of the moon, at 10h 43′ 12″.

The ſecond ſatellite diſappeared, without becoming at all indiſtinct, exactly at 10h 45′ 19″.

The weſtern limb of Jupiter came in contact, moſt diſtinctly, with the eaſtern limb of the moon, at 10h 46′ 32″,5.

Jupiter's eaſtern limb diſappeared, as diſtinctly, at 10h 48′ 20″,5. This immerſion took place, as repreſented in fig. 6. to the eaſtward of Ariſtarchus, at about the 25th degree of north latitude.

"The third ſatellite diſappeared, after having been for about one or two ſeconds faint and indiſtinct, at 10h 58′ 57″,5.

"The fourth ſatellite, which appeared the leaſt of them all, became undiſcernible near the limb, and vaniſhed at about 11h 2′ 16″.

"*Emerſions.* The two preceding firſt and ſecond ſatellites were here likewiſe of uſe in determining preciſely the emerſion of both the limbs of Jupiter from the dark hemiſphere of the moon.

"The firſt appearance of Jupiter's weſtern limb was very diſtinct at 11h 43′ 54″.

"Emerſion of the eaſtern limb, as diſtinct, at 11h 45′ 39″,5. This emerſion took place, as repreſented in fig. 7. to the north-eaſtward of Seneca (B, Tab. VIII. of the Frag.), at about the 23d degree of north latitude.

"The emerſion of the next, or third ſatellite, was not obſerved.

"That of the fourth was diſtinct at 11h 59′ 1″.

"This obſervation gave me the more ſatisfaction, as it ſingularly contributed to confirm the diſcovery I had been ſo fortunate as to make of the twilight in the moon, and the height and denſity of the lower ſtratum of its atmoſphere.

"Experience has ſufficiently proved, that a ſtronger will ever obſcure a fainter light; and it follows hence, that the light of a bright ſtar approaching the moon, when full or nearly ſo, will loſe ſomething of its luſtre: but little can be inferred in favour of an atmoſphere either of the Moon or of Mars, from the obſervation of Caſſini; in which, as Dr Herſchel has illuſtrated by ſome obſervations of his own*, a ſtar in Aquarius, of the ſixth magnitude, and as yet ſix minutes diſtant from Mars, diminiſhed in light when both were ſeen in the ſame field of the teleſcope. A mere apparent diminution of light, occaſioned by the glare of a larger luminous object, when ſeen at the ſame time with a ſmaller

* Phil. Tranſ. 1784.

smaller one in the field of the telescope, is one thing; and another thing is a real indistinctness of the small luminous body, which increases in proportion as they approach nearer to each other.

"It was very natural for Jupiter to diminish in brightness when it approached so near to the moon, then almost at its full, as to be seen at the same time in the field of the telescope, which was in fact the circumstance of this observation; but I could not observe any progressive variation of light in the eastern and western, equally luminous, disks, proportional to their distances from the limb of the moon, much less a real indistinctness; and this neither when the limbs of the two planets were nearly in contact, nor when Jupiter was partly, or about one half, covered by the moon.

"It was a sight truly gratifying to an eye accustomed to the light of the moon, or in general to similar observations, to behold how Jupiter, at its immersion as well as emersion, being half or more than half covered by the moon, exhibited its belts and other parts as distinctly close to the limb of the moon as it does at some distance from it; and had I not already succeeded in my numerous observations on the atmosphere of the moon, and very recently in those which enabled me to determine its twilight, I should perhaps have adopted the doubts the ancient astronomers entertained concerning the existence of a lunar atmosphere; and this the rather, as when Jupiter in its immersion was so far covered, that the luminous spot *l*, fig. 5. was close to the moon, I could plainly distinguish this spot, although it be in itself by no means very perceptible.

"Such, however, must have been the appearances, according to my new observations and measurements of the twilight of the moon: for if it be proved, that the extent of this twilight, to where it loses itself in the light reflected from the almost wholly illuminated disk of our earth, amounts to no more than an arc of 2° 34′ of the circumference of the moon, and if it be hence demonstrable, that its greatest dilatation does barely amount to 5″ 8′, and the perpendicular height of that part of the lower more condensed stratum of its atmosphere, which is capable of reflecting the solar rays, and of producing some other, perhaps more remarkable, obscurities in the stars seen through it, does not exceed 5000 Paris feet, and hence cannot reach above one second of a degree above the limb of the moon; we need not wonder that so small a magnitude, which loses itself in the inequalities of the limb, many parts of which are known to be considerably mountainous, should not become sensible, especially at the approach of a body of so large a diameter as Jupiter, and when so small a magnifying power is applied. And thus may I with confidence assert a perfect coincidence between this and my many other observations.

"The appearance, fig. 8. when Jupiter, at the emersion, the objects being particularly sharp and distinct, came forth from behind the moon, which now covered no more than one quarter of its diameter, was truly splendid and satisfactory: and I must here particularly mention the circumstance, that the part of the moon's dark hemisphere, between its bright terminating edge *m n* and its outward limb, bordering upon the emerging planet *o p*, was particularly opaque, and hence produced a very striking effect.

"I omit entering here upon any farther considerations; and shall conclude with observing, that, after the occultation was completely ended, the luminous spot *l* had at 12^h 1′ so far advanced in its parallel *de*, as to have reached to within $\frac{1}{8}$, or at most $\frac{1}{7}$, of its whole length of the western limb: and that on the 28th of March, five days after a new moon, I observed an occultation of a very distinct, though telescopic, star, by the dark hemisphere of the moon; in which, agreeably to the above observation, not the least gradual diminution of light or indistinctness could be perceived, the star being seen to vanish on a sudden."

Influence of the Moon *on the Human Body, the Weather*, &c. The vulgar doctrine concerning the influence of the moon on the changes of *weather* is very ancient, and has gained credit among the learned without sufficient examination; but it seems now to be pretty generally exploded by philosophers, as equally destitute of all foundation in physical theory, and unsupported by any plausible analogy. The common opinion is, that the lunar influence is exerted at the syzygies and quadratures, and for three days before and after each of those epochs. There are 24 days, therefore, in each synodic month, over which the moon at this rate is supposed to preside; and as the whole consists but of 29 days 12$\frac{3}{4}$ hours, only 5$\frac{1}{2}$ days are exempt from her pretended dominion. Hence, though the changes of the weather should happen to have no connection whatever with the moon's aspects, and they should be distributed in an equal proportion through the whole synodic month, yet any one who shall predict, that a change shall happen on some one of the 24 days assigned, rather than in any of the remaining 5$\frac{1}{2}$, will always have the chances 24 to 5$\frac{1}{2}$ in his favour. Men may, therefore, easily deceive themselves, especially in so unsettled a climate as ours. Moreover, the writers who treat of the signs of the weather, derive their prognostics from circumstances which neither argue any real influence of the moon as a cause, nor any belief of such an influence, but are merely indications of the state of the air at the time of observation: such are, the shape of the horns, the degree and colour of the light, and the number and quality of the luminous circles which sometimes surround the moon, and the circumstances attending their disappearance. (See the Διοσημεια of Aratus, and the *Scholia* of Theon.) The vulgar soon began to consider these things as causes, which had been proposed to them only as signs: and the notion of the moon's influence on all terrestrial things was confirmed by her manifest effect upon the ocean. See, on this subject, Phil. Transf. vol. lxv. part 2. p. 178, &c.

The famous Dr Mead was a believer in the influence of the sun and *moon* on the *human body*, and published a book to this purpose, intitled *De Imperio Solis ac Lunæ in Corpore humano:* but this opinion has been exploded by most philosophers as equally unreasonable in itself, and contrary to fact. As the most accurate and sensible barometer is not affected by the various positions of the moon, it is not thought likely that the human body should be affected by them. Several learned and ingenious men, however, still consider Dr Mead's doctrine as far from being unfounded.

Harvest-Moon. It is remarkable, that the moon, during the week in which she is full in harvest, rises sooner

fooner after fun-fetting than fhe does in any other full-moon week in the year. By doing fo, fhe affords an immediate fupply of light after fun-fet, which is very beneficial to the farmers for reaping and gathering in the fruits of the earth: and therefore they diftinguifh this full moon from all the others in the year, by calling it the *harveft-moon*. For an account of which, fee ASTRONOMY, n° 370, 371.

MOON-Eyes, in the manege. A horfe is faid to have moon-eyes when the weaknefs of his eyes increafes or decreafes according to the courfe of the moon; fo that in the wane of the moon his eyes are muddy and troubled, and at new moon they clear up; but ftill he is in danger of lofing his eye-fight quite.

MOON-Stone, a genus of filiceous earths, of a clear white colour approaching to that of milk. When looked at in a certain pofition, it reflects a ftrong light like mother-of-pearl; in others, it fhows fpots of a carnation colour. It is found in pieces with obtufe angles, fometimes of a quadrangular figure. When broken, it appears evidently foliated. According to Werner it agrees in hardnefs and moft other refpects with felt-fpar. He tells us, likewife, that it is probably the *androdamas* of Pliny, the common *girafole* of the Italians, and the *water opal* of Ceylon. Sometimes, he tells us, it is claffed with the opal, and fometimes with the cat's eye. According to M. Magellan, this ftone is of the chalcedony or pfeudo-opal kind: it reflects a whitifh light, with fome various fhades of few intermixed colours on a bluifh bottom, like the face of the moon when high enough not to appear reddifh by the interpofition of earthy vapours. The iris, or rainbow-ftone, feems to be no other than a moon-ftone in which the yellow, purple, and blue rays are moft confpicuoufly reflected. When looked at, it appears of a reddifh brown; but on holding it in the light of the fun, we difcover the figure of a rainbow. There are, however, feveral other ftones which have the fame appearance in the fun's light.

MOON-Wort in botany. See LUNARIA.

MOOR (Sir Karel de), a capital painter of portraits, hiftory, and converfations, was born at Leyden, in 1656: and at firft was a difciple of Gerard Douw, with whom he continued for a confiderable time. He afterwards ftudied fucceffively under Abraham Vanden Tempel, Francis Mieris, and Godfrey Schalcken. As foon as he began to follow his profeffion, the public in a fhort time did juftice to his extraordinary merit; and he took the moft effectual method to eftablifh his reputation, by working with a much ftronger defire to acquire fame than to increafe his fortune. According to Mr Pilkington, he painted portraits in a beautiful ftyle, in fome of them imitating the tafte, the dignity, the force, and the delicacy of Vandyck; and in others, he fhowed the ftriking effect and fpirit of Rembrandt. His pictures were always neatly and highly finifhed; he defigned them excellently, and grouped the figures of his fubjects with great fkill. His works were univerfally admired; and fome of the moft illuftrious princes of Europe feemed folicitous to employ his pencil. The grand duke of Tufcany defired to have the portrait of De Moor, painted by himfelf, to be placed in the Florentine gallery; and on the receipt of it, that prince fent him in return a chain of gold and a large medal of the fame metal. The Imperial ambaffador count Sinzendorf, by order of his mafter, engaged him to paint the portraits of Prince Eugene and the duke of Marlborough on horfeback; and in that performance, the dignity and expreffion of the figures, and alfo the attitudes of the horfes, appeared fo mafterly, that it was beheld with admiration, and occafioned many commendatory poems in elegant Latin verfe to be publifhed to the honour of the artift; and the emperor, on feeing that picture, created De Moor a knight of the holy Roman empire. He likewife had the honour to paint the portrait of Peter the great czar of Mufcovy; and an extraordinary number of other portraits, for which he received very large prices.—His hiftorical paintings were admirable; although he moft frequently was employed to paint in a large fize, yet he often painted fmall eafel pictures, with fubjects of hiftory or converfations; and thofe are exceedingly valued, having all the merit of neat penciling and fweet colouring added to an elegant tafte of defign. He died in 1738.

MOOR, in country affairs, denotes an unlimited tract of land, ufually over-run with heath.

MOOR-Cock, or *Gor-Cock*. See TETRAO.

MOOR Land, or *moory foil*, in agriculture, is a black, light, and foft earth, very loofe, and without any admixture of ftones; and with very little clay or fand.

The uppermoft ftratum of the fen-lands is ufually of this earth, and it commonly conftitutes a moderately thick or deep bed. Intermixed with water it cannot eafily be worked up into a pafte; and when with labour worked up into fomewhat of a firm mafs, its furface appears fpongy and porous; and as foon as dry, it eafily moulders away to powder.

It is ufually foft to the touch, unlefs it be worked very clofely between the fingers; then it fhows a mixture of a fmall quantity of fand, both to the touch and to the eye. It feems indeed to confift almoft entirely of pure vegetable matter; and this lying in fuch plenty on the furface of the fen-lands is the caufe of their being fo very fertile.

The great difadvantage of the places which have this foil, is their being liable to be glutted with wet; and to remedy the inconveniences arifing from thence, the farmers who rent thefe lands have a cuftom of burning the foil at proper feafons. It burns very freely and eafily, the furface readily catching flame; and a fubftance fomewhat bituminous, ufually contained among the foil, helps the burning.

MOORE, or MORE, (Edward), a late ingenious writer, was bred a linen-draper, but quitted bufinefs to join the retinue of the mufes; and he certainly had a very happy and pleafing talent for poetry. In his *Trial of Selim the Perfian*, he complimented lord Lyttelton in an elegant kind of panygeric, couched under the appearance of accufation: and his *Fables for the female fex*, for eafy verfification, poignant fatire, and ftriking morals, approach nearer to the manner of Gay than any other of the numerous imitations of that author. He wrote alfo three dramatic pieces; The Gamefter, a tragedy; The Foundling, and Gil Blas, comedies. The fuccefs of thefe was not fuch as they merited: the firft of them having met with a cold reception,

ception, for no other apparent reafon but becaufe it too nearly touched a favourite and fafhionable vice: and the fecond having been condemned for its fuppofed refemblance to Sir Richard Steele's *Confcious Lovers*, but to which good judges have been inclined to give it greatly the preference. Mr Moore married a lady of the name of *Hamilton*, daughter to Mr Hamilton table-decker to the princeffes; who had herfelf a very poetical turn, and has been faid to have affifted him in the writing of his tragedy. One fpecimen of her poetry, however, was handed about before their marriage, and has fince appeared in print in different collections of fongs, particularly in one called the *Goldfinch*. It was addreffed to a daughter of the famous Stephen Duck; and begins with the following ftanza:

> Would you think it, my Duck? (for the fault I muft own),
> Your Jenny at laft is quite covetous grown:
> Tho' millions if Fortune fhould lavifhly pour,
> I ftill fhou'd be wretched if I had not MORE.

And after half a dozen ftanzas more, in which, with great ingenuity and delicacy, and yet in a manner that expreffes a fincere affection, fhe has quibbled on our author's name, fhe concludes with the following lines:

> You may wonder, my girl, who this dear one can be,
> Whofe merit can boaft fuch a conqueft as me:
> But you fhan't know his name, tho' I told you before,
> It begins with an M, but I dare not fay MORE.

In the year 1753, Mr Moore commenced a weekly mifcellaneous paper, intitled *The World, by Adam Fitz-Adam*; in which undertaking he was affifted by Lord Chefterfield with fome effays. This paper was collected into volumes, and Mr Moore died foon after.

MOORING, the act of confining and fecuring a fhip in a particular ftation, by chains or cables, which are either faftened to the adjacent fhore, or to anchors in the bottom.

A fhip may be either moored by the head, or by the head and ftern: that is to fay, fhe may be fecured by anchors before her, without any behind; or fhe may have anchors out, both before and behind her; or her cables may be attached to pofts, rings, or moorings, which anfwer the fame purpofe.

When a fhip is moored by the head with her own anchors, they are difpofed according to the circumftances of the place where fhe lies, and the time fhe is to continue therein. Thus wherever a tide ebbs and flows, it is ufual to carry one anchor out towards the flood, and another towards the ebb, particularly where there is little room to range about; and the anchors are laid in the fame manner, if the veffel is moored head and ftern in the fame place. The fituation of the anchors, in a road or bay, is ufually oppofed to the reigning winds, or thofe which are moft dangerous; fo that the fhip rides therein with the effort of both her cables. Thus if fhe rides in a bay, or road, which is expofed to a northerly wind and heavy fea from the fame quarter, the anchors paffing from the oppofite bows ought to lie eaft and weft from each other: hence both the cables will retain the fhip in her ftation with equal effort againft the action of the wind and fea.

MOORINGS, in fea-language, are ufually an affemblage of anchors, chains, and bridles, laid athwart the bottom of a river or haven, to ride the fhipping contained therein. The anchors employed on this occafion have rarely more than one fluke, which is funk in the water near low-water mark. Two anchors being fixed in this manner in the oppofite fide of the river, are furnifhed with a chain extending acrofs from one to the other. In the middle of the chain is a large fquare link, whofe lower end terminates in a fwivel, which turns round in the chain as about an axis, whenever the fhip veers about with the change of the tide. To this fwivel-link are attached the bridles, which are fhort pieces of cable, well ferved, whofe upper ends are drawn into the fhip at the mooring-ports, and afterwards faftened to the mafts or cable-bolts. A great number of moorings of this fort are fixed in the harbours adjacent to the king's dock-yards, as Deptford, Chatham, Portfmouth, Plymouth, &c.

Moorlands ‖ Mopfus.

MOORLANDS, a tract fo called, in the north part of Staffordfhire, where the land rifes gradually into fmall hills, which run through the midft of England in one continued ridge, rifing higher and higher to Scotland, and fending forth many rivers. The foil here is fo foul and cold, that the fnows lie almoft all the year on the tops of the hills; and it is withal very rugged and barren: it, however, yields plenty of coal, lead, copper, rance-marble, and mill-ftones; and fome of the limeftone hills bear fuch a fweet though fhort grafs, as is very grateful to the oxen, of which here is a very good breed. It is obferved here, that the weft wind always brings rain, and the eaft and fouth fair weather; that though this tract is full of bogs, it is as healthy as any other part of the county; and that it produces the fame plants as the Peak of Derby.

MOORS. See MOROCCO.

MOORS, in the Ifle of Man, thofe who fummon the courts for the feveral fheadings; fuch as the lord's bailiffs. Every moor has the like office with our bailiff of the hundred.

MOOSE, or ELK. See CERVUS.

MOOT, a difficult cafe, argued by the young barrifters and ftudents at the inns of court, by way of exercife, the better to qualify them for practice; and to defend the caufes of their clients. This, which is called *mooting*, is the chief exercife of the inns of court. Particular times are appointed for the arguing moot-cafes: the place where this exercife is performed was anciently called *moot-hall;* and there is a bailiff, or furveyor of the moots, annually chofen by the bench, to appoint the moot-men for the inns of chancery, and to keep an account of the performance of exercifes. The word is formed either from the Saxon *metan*, *gemetan*, "meeting;" or from the French *mot*, "word."

MOPSUS (fab. hift.), a celebrated prophet, fon of Manto and Apollo during the Trojan war. He was confulted by Amphimachus, king of Colophon, who wifhed to know what fuccefs would attend his arms in a war which he was going to undertake. He predicted the greateft calamities; but Calchas, who had been a foothfayer of the Greeks during the Trojan war, promifed the greateft fucceffes. Amphimachus followed the opinion of Calchas; but the prediction of Mopfus was fully verified. This had fuch an effect upon Calchas, that he died foon after. His death

is attributed by fome to another mortification of the fame nature. The two foothfayers, jealous of each other's fame, came to a trial of their fkill in divination. Calchas firft afked his antagonift, how many figs a neighbouring tree bore? 10,000 except one, replied Mopfus, and one fingle veffel can contain them all. The figs were gathered, and his conjectures were true. Mopfus now, to try his adverfary, afked him how many young ones a certain pregnant fow would bring forth? Calchas confeffed his ignorance; and Mopfus immediately faid that the fow would bring forth on the morrow ten young ones, of which only one fhould be a male, all black, and that the females fhould all be known by their white ftreaks. The morrow proved the veracity of his prediction; and Calchas died by excefs of the grief which his defeat produced. Mopfus after death was ranked among the gods, and had an oracle at Malia, celebrated for the true and decifive anfwers which it gave—Another *Mopfus*, fon of Ampyx and Chloris, born at Titareffa in Theffaly. He was the prophet and foothfayer of the Argonauts, and died at his return from Colchis by the bite of a ferpent in Libya. Jafon erected him a monument on the fea-fhore, where afterwards the Africans built him a temple where he gave oracles. He has often been confounded with the fon of Manto, as their profeffions and their names were alike.

MORÆA, in botany: A genus of the monogynia order, belonging to the triandria clafs of plants; and in the natural method ranking under the 6th order, *Enfatæ*. The corolla is hexapetalous; the three interior petals patent, the reft like thofe of the iris.

MORAI, is the name given at Otaheite in the South Sea to their burying-grounds, which are alfo places of worfhip. This is a pile of ftone raifed piramidically upon an oblong bafe or fquare 267 feet long and 87 wide. On each fide is a flight of fteps; thofe at the fides being broader than thofe at the ends; fo that it terminated not in a fquare of the fame figure with the bafe, but in a ridge like the roof of a houfe. There were 11 of thefe fteps to one of thefe morais, each of which was 4 feet high, fo that the height of the pile was 44 feet; each ftep was formed of one courfe of white coral ftone, which was neatly fquared and polifhed; the reft of the mafs (for there was no hollow within) confifted of round pebbles, which from the regularity of their figure feemed to have been wrought. The foundation was of rock-ftones, which were alfo fquared. In the middle of the top ftood an image of a bird carved in wood, and near it lay the broken one of a fifh carved in ftone. The whole of this pyramid made part of one fide of a fpacious area or fquare 360 feet by 354, which was walled in with ftone, and paved with flat ftones in its whole extent. About 100 yards to the weft of this building was another paved area or court, in which were feveral fmall ftages raifed on wooden pillars about 7 feet high, which are called by the Indians *ewattas*, and feem to be a kind of altars, as upon thefe are placed provifions of all kinds, as offerings to their gods. On fome of them are feen whole hogs, and on others the fkulls of above 50, befides the fkulls of many dogs. The principal object of ambition among the natives is to have a magnificent morai. The male deities (for they have them of both fexes) are worfhipped by the men, and the female by the women; and each have morais, to which the other fex is not admitted, though they have alfo morais common to both.

MORAL PHILOSOPHY, OR MORALS.

MORAL PHILOSOPHY is, "The fcience of MANNERS OR DUTY; which it traces from man's nature and condition, and fhows to terminate in his happinefs." In other words, it is "The knowledge of our DUTY and FELICITY;" or, "The art of being VIRTUOUS and HAPPY."

It is denominated an *art*, as it contains a fyftem of rules for becoming virtuous and happy. Whoever practifes thefe rules, attains an habitual power or facility of becoming virtuous and happy. It is likewife called a *fcience*, as it deduces thofe rules from the principles and connections of our nature, and proves that the obfervance of them is productive of our happinefs.

It is an art, and a fcience, of the higheft dignity, importance, and ufe. Its object is man's duty, or his conduct in the feveral moral capacities and connections which he fuftains. Its office is to direct that conduct; to fhow whence our obligations arife, and where they terminate. Its ufe, or end, is the attainment of happinefs; and the means it employs are rules for the right conduct of our moral powers.

Moral Philofophy has this in common with Natural Philofophy, that it appeals to nature or fact; depends on obfervation; and builds its reafonings on plain uncontroverted experiments, or upon the fulleft induction of particulars of which the fubject will admit. We muft obferve, in both thefe fciences, how nature is affected, and what her conduct is in fuch and fuch circumftances: Or, in other words, we muft collect the appearances of nature in any given inftance; trace thefe to fome general principles or laws of operation; and then apply thefe principles or laws to the explaining of other phenomena.

Therefore Moral Philofophy inquires, not how man might have been, but how he is, conftituted: not into what principles or difpofitions his actions may be artfully refolved; but from what principles and difpofitions they actually flow: not what he may, by education, habit, or foreign influence, come to be or do; but what, by his nature, or original conftituent principles, he is formed to be and do. We difcover the office, ufe, or deftination of any work, whether natural or artificial, by obferving its ftructure, the parts of which it confifts, their connection or joint action. It is thus we underftand the office and ufe of a watch, a plant, an eye, or hand. It is the fame with a living creature of the rational or brute kind. Therefore, to determine the office, duty, or deftination of man; or, in other words, what his bufinefs is, or what conduct he

he is obliged to purſue; we muſt inſpect his conſtitution, take every part to pieces, examine their mutual relations one to the other, and the common effort or tendency of the whole.

It has not been thus, however, that the ſcience has always been taught. The earlieſt moraliſts did not erect ſyſtems upon a juſt analyſis of the powers of the human mind; nor have all thoſe who thought ſuch a foundation neceſſary to be laid, deduced their theories from the very ſame principles. As moral truths are not capable of rigid demonſtration, it appears to us, that we cannot more properly introduce the ſyſtem which we have adopted, than by giving our readers a ſhort view of the moſt celebrated ſyſtems that have been maintained by others. They will thus have an opportunity of judging for themſelves of the reſpective merits of the different theories, and of adopting that which ſhall appear to them to place practical virtue on the firmeſt baſis.

History of the Science of Morals.

1 ...ous o-...ons ...erning ...criteri-...f vir-...&c.

WHILST there has been a remarkable agreement among the writers on morality, as to the particular actions which are virtuous and thoſe which are vicious; and whilſt they have uniformly taught, that it is our duty and our intereſt to perform the one and to avoid the other; they have yet differed exceedingly concerning the *teſt* or *criterion* of virtue, as well as concerning the *principle* or *motive* by which men are induced to purſue it. One cauſe of this difference in opinion reſpecting matters of ſuch univerſal importance, may perhaps be traced to the miſtakes into which philoſophers are apt to fall concerning the original ſtate of man.

2 ...able ...of this ...ty.

It is very generally taken for granted, that the firſt men were ſavages of the loweſt rank, and that the race gradually civilized itſelf during the courſe of many ſucceeding ages. Without mutual intercourſe, the progreſs of civilization could never have commenced; and as the practice of juſtice is abſolutely neceſſary to every ſpecies of friendly intercourſe, thoſe original ſavages, it is ſuppoſed, muſt have been juſt in their dealings, and juſt upon ſome principle which has its foundation in human nature. But to develope the principle by which ſavages are influenced in their conduct, no tedious or intricate proceſs of reaſoning can be neceſſary. It muſt have a place in every mind, and be inſtantaneous in all its deciſions. Hence it has been ſuppoſed, that the principle to which modern philoſophers have given the name of the *moral ſenſe*, is inſtinctive; that it is the ſole judge of virtue and vice; and that its admonitions have ſuch authority, as to enforce obedience without regard to the conſequences of any action.

Other philoſophers, who deny that the moral ſenſe is inſtinctive, and who yet ſuppoſe that the original ſtate of man was ſavage, are forced to pile hypotheſis upon hypotheſis, each unnatural in itſelf, and all contradictory to one another, in order to account for the commencement of civilization and the formation of ſociety. It has been ſuppoſed, that the deſire of ſelf-preſervation and the love of power are the governing principles in human nature; that in the ſavage ſtate every man had a right to every thing which he could ſeize by fraud or force; that all had an innate propenſity to invade each other's property; and that hence war, rapine, and bloodſhed, prevailed univerſally, till the ſavages diſcovered the expediency of uniting under ſome form of government for their mutual protection.

But before the original ſtate of man had been made the baſis of ſuch oppoſite theories as theſe, it would ſurely have been proper to inquire upon what grounds that ſtate has been ſuppoſed to be ſavage. To us theſe grounds appear to be nothing better than mere imaginations; the dreams of poets, and of ſuch philoſophers as bend facts to their own ſyſtems. In the authentic *hiſtory* of our ſpecies, there is no evidence, indeed there can be no evidence, that the firſt men were ſavages; and every thing which we know of human nature leads us to believe, that had they been ſo, the race could never have been civilized but by the miraculous interpoſition of ſome ſuperior being. The only record of the earlieſt ages of the world to which the ſmalleſt credit is due, repreſents all the nations of the earth as having ſprung from one pair, and that pair as having been inſtructed in their duty by their beneficent Creator. If this be the fact, and no conſiſtent theiſt can controvert it, the precepts of morality would be originally conveyed from one generation to another; not in a ſyſtematical or ſcientific form, but as the laws of the Univerſal Sovereign, whoſe authority demanded implicit obedience. Accordingly we find, that the firſt teachers of morals were men of ſuperior rank as well as of eminent talents, who formed collections of maxims derived from their anceſtors, "with the view of perfecting ſubordination‡, poliſhing manners, and educating youth. Such were the proverbs of Solomon, the words of Agur, and the wiſdom of the ſon of Sirach." Theſe inſtructors did not analyſe the human mind into its various faculties, and build a ſyſtem of morals either upon a particular inſtinct pointing to the ſupreme good, or upon the fitneſs of things diſcovered by reaſon. Short iſolated ſentences were the mode in which they conveyed their precepts; which they prefaced by obſerving, that "the fear of the Lord is the beginning of knowledge;" and enforced by the aſſurance, that "length of days, and long life, and peace, ſhould they add to thoſe who obeyed them." The ſayings of the celebrated wiſe men of Greece were collections of apophthegms, made in the ſame manner, and delivered with ſimilar views. Thales and Pythagoras†, who founded the one the Ionic and the other the Italic ſchool, made collections of precepts for the conduct as well of a ſtate as of private life. "Neither the crimes nor the thoughts of bad men (ſaid Thales) are concealed from the gods. The only method of being juſt, is to avoid doing that which we blame in others." Of Pythagoras it is related by Porphyry and Laertius, that from Samos he repaired to Delos, and after preſenting an offering of cakes to Apollo, there received, or pretended to receive, moral dogmas from the prieſteſs; which he afterwards delivered to his diſciples under the character of divine precepts. Amongſt theſe were the following: That, "next to gods and demons, the higheſt reverence is due to parents and legiſlators; and that the laws and cuſtoms of our country are to be religiouſly obſerved."

3 Modes of communicating inſtruction by the earlieſt moraliſts.

‡ *Bruce's Elements of the Science of Ethics.*

† *Bruce's Elements*, and *Enfield's Hiſtory of Philoſophy.*

To theſe maxims or apophthegms, which, for the ſake of delighting the ear and aiding the memory,

were fometimes delivered in verfe, fucceeded, as has been fuppofed, the mode of inftruction by fable or allegory. But the truth feems to be, that this method of communicating moral and political wifdom was as ancient as the other; for we have a beautiful fpecimen of it in the ninth chapter of the book which relates the tranfactions of the Judges of Ifrael. The fables of Efop, too, which were written at a very early period, remain lafting models of this fpecies of art among the Greeks.

When the inftructors of mankind had proceeded thus far as to give an artificial form to their precepts, they foon advanced a ftep farther, and reduced their obfervations into claffes or predicaments. Pythagoras, who vifited Egypt, has been fuppofed to have learned from its priefts the method of arranging the virtues into diftinct claffes. But it is the opinion of an excellent writer †, founded on the previous afpects of ethics, and on the comprehenfive talents of the Samian philofopher, that the honour of the invention ought to be afcribed to himfelf. Be this as it may, it was obferved by the inventor, that "all the maxims of morality might be referred to the duties which men owe to themfelves, and the duties which they owe to each other." Hence the four cardinal virtues of the ancients, PRUDENCE, TEMPERANCE, FORTITUDE, and JUSTICE; of which the firft three refer to the individual, and the fourth to fociety.

† *Mr Bruce.*

4
The moral principles of Socrates.

Hitherto leffons in morality had not taken a fyftematic form; but they were gradually approaching to it. Socrates was perhaps the firft Pagan philofopher who eftablifhed all his precepts on one fure and fteady bafis. In his lectures and difcourfes, he feems to have had one great object in view §, to connect the moral maxims which were fitted to regulate the conduct of mankind, with fublime conceptions refpecting the character and government of a fupreme Being. The firft principles of virtuous conduct which are common to all mankind, are, according to this excellent moralift, laws of God: and the conclufive argument by which he fupports this opinion is, that no man departs from thefe principles with impunity. "It is frequently poffible (fays he) for men to fcreen themfelves from the penalty of human laws, but no man can be unjuft or ungrateful without fuffering for his crime; hence I conclude, that thefe laws muft have proceeded from a more excellent legiflator than man." From this it would appear, that in the opinion of Socrates, confcience, or the moral fenfe, approving of any action, is the criterion by which it is known to be virtuous, and the will of God that which obliges men to perform it.

§ *Bruce's Elements, and Enfield's Hiftory, &c.*

5
Origin of the Greek fects.

Socrates himfelf left no writings behind him, nor, as far as we know, offered any regular and complete theory of ethics. His difciples, however, who were numerous and diftinguifhed, became the founders of the celebrated Greek fects. Among them the firft great queftion was, "what are the foundations of virtue?" and the fecond, "what are the diftinctions betwixt good and evil, happinefs and mifery?" The anfwers given to thefe important queftions divided the philofophers and their difciples into diftinct orders.

* *Enfield.*

In anfwer to the former queftion, Plato taught *, that "virtue is to be purfued for its own fake; and that being a divine attainment, it cannot be taught, but is the gift of God." This feems to differ in nothing but the name from the doctrine of thofe moderns who place the fole foundation of virtue in the approbation of the moral fenfe. The founder of the academy indeed has no fuch phrafe as *moral fenfe* in any of his writings with which we are acquainted; but if virtue cannot be taught, and if it is to be purfued for its own fake, it muft in itfelf be *good*, and the object of fome feeling, whether called *fenfe*, *inftinct*, or *paffion*. His folution of the fecond queftion agitated among the fects is not indeed very confiftent with this neceffary inference from his anfwer to the firft; but for his inconfiftencies we are not accountable. "Our higheft good (he fays) confifts in the contemplation and knowledge of the firft good, which is mind or God; and all thofe things which are called *good* by men, are in reality fuch only fo far as they are derived from the firft and higheft good. The only power in human nature which can acquire a refemblance to the fupreme good, is reafon; and this refemblance confifts in prudence, juftice, fanctity, and temperance."

6
Theory of Plato.

7
Of Ariftotle.

Ariftotle, the founder of the Peripatetic fchool, was the pupil of Plato; but of the two great moral queftions he gives folutions fomewhat different from thofe of his mafter. "Virtue (according to him ‡) is either theoretical or practical. Theoretical virtue confifts in the due exercife of the underftanding; practical, in the purfuit of what is *right* and *good*. Practical virtue is acquired by habit and exercife." This theory feems to differ little from that adopted by Cudworth, Clarke, and Price, which fhall be confidered afterwards. With refpect to happinefs or good, the doctrine of Ariftotle is very rational. "Pleafures (he fays) are effentially different in kind. Difgraceful pleafures are wholly unworthy of the name. The pureft and nobleft pleafure is that which a good man derives from virtuous actions. Happinefs, which confifts in a conduct conformable to virtue, is either contemplative or active. Contemplative happinefs, which confifts in the purfuit of knowledge and wifdom, is fuperior to active happinefs, becaufe the underftanding is the higher part of human nature, and the objects on which it is employed are of the nobleft kind. The happinefs which arifes from external poffeffions is inferior to that which arifes from virtuous actions; but both are neceffary to produce perfect felicity."

‡ *Enfield.*

8
Of the Stoics.

The Stoics, another celebrated fect of Greek philofophers, maintained †, that "nature impels every man to purfue whatever appears to him to be good." According to them, "felf-prefervation and defence is the firft law of animated nature. All animals neceffarily derive pleafure from thofe things which are fuited to them; but the firft object of purfuit is, not pleafure, but conformity to nature. Every one, therefore, who has a right difcernment of what is good, will be chiefly concerned to conform to nature in all his actions and purfuits. This is the origin of moral obligation." With refpect to happinefs or good, the ftoical doctrine was altogether extravagant: They taught, that "all external things are indifferent, and cannot affect the happinefs of man; that pain, which does not belong to the mind, is no evil; and that a wife

† *Enfield.*

wiſe man will be happy in the midſt of torture, becauſe virtue itſelf is happineſs (B)."

As the Stoics held that there is but one ſubſtance, partly active and partly paſſive, in the univerſe (ſee METAPHYSICS, nº 261, 262.), and as they called the active principle *God*, their doctrine, which makes virtue conſiſt in a conformity to *nature*, bears no ſmall reſemblance to that of thoſe moderns who reſt moral obligation on the *Divine will*. It was therefore on better grounds than has been ſometimes ſuppoſed, that Warburton, when characterizing the founders of the three principal ſects in Greece, repreſented ‡ *Plato* as the patron of the *moral ſenſe*; *Ariſtotle*, of the *eſſential differences*; and *Zeno*, of *arbitrary will*. Theſe principles, when ſeparated from each other, and treated in the manner of the ancients, may not each be able to bear the ſuperſtructure which was raiſed upon it; but the principles of moſt of the other ſects were much leſs pure, and infinitely more dangerous.

Cudworth §, whoſe teſtimony when relating the doctrines of antiquity is entitled to the fulleſt credit, affirms, that Ariſtippus the founder of the Cyrenaic ſchool, Democritus, and Protagoras, with their followers among the atomiſts, taught, that "the diſtinction between virtue and vice is merely arbitrary; that nothing is juſt or unjuſt, ſacred or profane, but as it is agreeable or contrary to eſtabliſhed laws and cuſtoms; that what is juſt to-day, human authority may make unjuſt to-morrow; and that preſent pleaſure is the ſovereign good of man."

With theſe impieties, the moral doctrines of Epicurus have very unjuſtly been confounded. The phyſical and metaphyſical ſyſtems of that philoſopher are indeed ſtrange compoſitions of ingenuity and abſurdity, truth and falſehood; and the moral precepts of many of his followers were in the higheſt degree licentious and impure. But his own life was exemplary; and his ethical ſyſtem, if candidly interpreted, is much more rational than that of the Stoics; though it muſt be confeſſed, that no ſect produced men of more determined virtue than the ſchool of Zeno.—According to Epicurus *, "the end of living, or the ultimate good which is to be ſought for its own ſake, is happineſs. The happineſs which belongs to man, is that ſtate in which he enjoys as many of the good things, and ſuffers as few of the evils incident to human nature as poſſible; paſſing his days in a ſmooth courſe of tranquillity. Pleaſure is in its own nature good, as pain is in its nature evil. The one is therefore to be purſued, and the other to be avoided, for its own ſake. Pleaſure and pain are not only good and evil in themſelves, but they are the meaſure of what is good or evil in every object of deſire and averſion; for the ultimate reaſon why we purſue one thing and avoid another is, becauſe we expect pleaſure from the former, and apprehend pain from the latter. That pleaſure, however, which prevents the enjoyment of a greater pleaſure, or produces a greater pain, is to be ſhunned; and that pain, which either removes a greater pain, or procures a greater pleaſure, is to be endured."

Upon theſe ſelf-evident maxims, Epicurus builds his ſyſtem of ethics; and proves, with great force of argument, "that a ſteady courſe of virtue produces the greateſt quantity of happineſs of which human nature is capable." Without a *prudent* care of the body, and a ſteady government of the mind to guard the one from diſeaſes and the other from the clouds of prejudice, happineſs is unattainable. By *temperance* we enjoy pleaſure, without ſuffering any conſequent inconvenience. *Sobriety* enables us to content ourſelves with ſimple and frugal fare. *Gentleneſs*, as oppoſed to an iraſcible temper, greatly contributes to the tranquillity and happineſs of life, by preſerving the mind from perturbation, and arming it againſt the aſſaults of calumny and malice. *Fortitude* enables us to bear thoſe pains which prudence cannot ſhun, and baniſhes fear from the mind; and the practice of *juſtice* is abſolutely neceſſary to the exiſtence of ſociety, and by conſequence to the happineſs of every individual." Theſe reaſonings come home to every man's boſom; and had not this philoſopher, by denying the providence, if not the being, of God, moſt unhappily excluded from his ſyſtem the very poſſibility of a future ſtate of retribution, his moral philoſophy would have been the moſt rational, and of courſe the moſt uſeful, of any that was taught in the ſchools of Greece. This enormous defect, however, laid it open to the groſſeſt corruptions; and by his followers it was in fact corrupted ſo as to countenance the moſt impure and criminal pleaſures of ſenſe.

11 The eclectic philoſophers of Alexandria.

Theſe ſeveral ſyſtems of ethics continued to be cultivated with more or leſs purity through all the revolutions of the Grecian ſtates, and they were adopted by the Romans after Greece itſelf became a province of the empire. They had been introduced into Egypt during the reigns of the Ptolemies, and were taught with much celebrity in the ſchools of Alexandria.—The philoſophy which was moſt cultivated in thoſe ſchools was that of Plato; but from a deſire of uniformity which took poſſeſſion of the Alexandrian Platoniſts, many of the dogmas of Ariſtotle and Zeno, as well as the extravagant fictions of the eaſt, were incorporated with the principles of the old academy.—The patrons of this heterogeneous maſs have been called *eclectic* philoſophers, becauſe they profeſſed to ſelect from each ſyſtem thoſe doctrines which were rational and important, and to reject every thing which was falſe or futile; but they added nothing to the purity of Plato's ethics, and they increaſed the obſcurity and myſticiſm of his phyſics and metaphyſics.

12 Extinction and revival of moral ſcience in Europe.

After the ſubverſion of the Roman empire, every ſpecies of philoſophy, if ſyllogiſtic wrangling deſerve not that name, was baniſhed for ages from the ſchools of Europe; and ethics, properly ſo called, gave place to eccleſiaſtical caſuiſtry, and to the ſtudy of the civil and canon law. When the Greeks, whom the fury and fanaticiſm of Mahomet II. had driven from Conſtantinople, introduced into Italy the knowledge of their own language, the cabinets of ancient philoſophy were again unlocked; the ſyſtems of the different ſects were adopted with the utmoſt avidity; and, without accurate

(B) Since this ſhort hiſtory was written, a very pleaſing view of Stoiciſm has been given to the public in Ferguſon's *Principles of moral and political Science*; a work which the ſtudent of ethics will do well to conſult. Perhaps the amiable author may unintentionally have ſoftened the auſtere dogmas of the Porch, by transfuſing into them ſomething of the mild ſpirit of the goſpel; but if ſo, he has much improved the ſyſtem of Zeno.

accurate investigation of their respective merits, men became Platonists, Peripatetics, or Stoics, as fancy or caprice prompted them to choose their leaders. The αυτος εφα of Aristotle, in particular, had not less authority over his modern admirers than it had of old in the Lyceum at Athens. At length the spirit of Luther and the genius of Bacon broke these fetters, and taught men to think for themselves as well in science as in religion. In physics, the effects produced by the writings of Bacon were great and rapid; for in physics the ancient theories were totally and radically wrong.—With respect to morals, however, the case was different. Each of the celebrated schools of antiquity was in possession of much moral truth, blended indeed with error; and long after the Stagyrite and his rivals had lost all influence in physical science, philosophers of eminence followed them implicitly in the science of ethics.

13 Theories of Hobbes. At this day, indeed, there is hardly a theory of morals at all distinguished, to which something very similar may not be found in the writings of the ancients.—Hobbes adopted the principles of Democritus and Protagoras, and taught expressly that "there is no criterion of justice or injustice, good or evil, besides the laws of each state; and that it is absurd to inquire at any person except the established interpreters of the law, whether an action be right or wrong, good or evil (A)." These impious absurdities have been often confuted. Cudworth, who composed his *True Intellectual System of the Universe* in order to trace the metaphysical atheism of Hobbes to its source, and to expose it to the public in all its weakness, undertook likewise to overthrow his ethical system, in a treatise, intitled *Of Eternal and Immutable Morality*. That work was left unfinished; but the theory of its great author was adopted, illustrated, and very ably supported, by the Doctors Clarke and Price.

14 Of Cudworth, Clarke, and Price. According to these three admirable scholars, "we feel ourselves irresistibly determined to approve some actions, and to disapprove others. Some actions we cannot but conceive of as *right*, and others as *wrong*; and of all actions we are led to form some idea, as either *fit* to be performed or *unfit*, or as neither fit nor unfit to be performed, i. e. as *indifferent*. The power within us which thus perceives and determines, they declare to be the *understanding*; and they add, that it perceives or determines immediately or by intuition, because *right* and *wrong* denote *simple ideas*. As there are some propositions, which when attended to necessarily determine all minds to *believe* them, so are there some actions whose natures are such, that when observed all rational beings immediately and necessarily *approve* them. He that can impartially attend, it is said, to the nature of his own perceptions, and determine that when he conceives gratitude or beneficence to be *right*, he perceives nothing *true* of them, or *understands* nothing, but only *suffers* from a sense, has a turn of mind which appears unaccountable: for the more we examine, the more indisputable it will appear to us, that we express *necessary* truth, when we say of some actions that they are right, and of others that they are wrong." It is added, that "we cannot perceive an action to be right without *approving* it, or *approve* it without being conscious of some degree of *satisfaction* and complacency; that we cannot perceive an action to be wrong without *disapproving* it, or *disapprove* it without being *displeased* with it; and that the *first* must be liked, the *last* disliked; the *first* loved, the *last* hated." By the patrons of this system, *obligation* to action, and *rightness* of action, are held to be coincident or identical. "Virtue, they affirm, has a real, full, obligatory power, antecedently to all laws, and independently of all will; for obligation is involved in the very nature of it. To affirm that the performance of that which to omit would be wrong is not obligatory, unless conducive to private good, or enjoined by a superior power, is a manifest contradiction *."

* *Pri[ce's] Revie[w] and C[...] on the [...] bute[s].*

Few men have deserved better of letters and philosophy than Cudworth, Clarke, and Price; and yet their theory of morals appears to us to be contradictory and unintelligible. It is certainly romantic, and founded upon principles which, if they be denied, no man by argument can be compelled to grant. There is, say they, an absolute right and wrong, fitness and unfitness, in actions; but if so, the actions which are *right* and *fit* must be right and fit for something, because fitness, which respects no end, is wholly inconceivable. To say that any particular action is *fit*, and yet fit for *no particular purpose*, is just as absurd as to say that the angles at the base of an isosceles triangle are *equal*, but neither to *one another*, nor to *any other angles*; and we may with no less propriety talk of the relation of equality attaching to a particular angle, and to nothing else with which the angle is equal, than of the *absolute* fitness or rightness of any action or course of actions. If it be said that such actions are fit and right, because they tend to promote the harmony of the world and the happiness of men, this may be granted; but it overturns the intellectual theory from its very foundation. Actions which are fit and right only for their consequences, are approved and liked for the sake of those consequences; and the happiness of men, among whom the virtuous person himself is certainly to be included, is the motive or ultimate obligation to their performance.

Similar to this theory, and liable to the same objections, is that which resolves moral approbation into a sense of propriety; for if actions be approved because they are proper, it must be because they are proper for some *end* or *purpose*, propriety in the abstract being a word without meaning.

Many philosophers, feeling the force of these and of similar objections to the intellectual theory of Cudworth, Clarke, and Price, as well as to a sense of *propriety* in the abstract, have had recourse to another hypothesis apparently better founded. Observing that all mankind decide on the morality of characters and actions instantaneously, without weighing their consequences in the balance of reason, they suppose that such decisions are made by an *instinct* of our common nature, implanted in the human breast by the hand that formed it. To this instinct some of them give the [15 Of L[...] Shaft[esbury] and [Hut]cheso[n]]

(c) Doctrinas de justo et injusto, bono et malo, præter leges in unaquaque civitate constitutas, authenticas esse nullas: et utrum aliqua actio justa vel injusta, bona vel mala futura sit, a nemine inquirendum esse, prætequam ab illis, quibus legum suarum interpretationem civitas demandaverit. *De cive*, p. 343.

the name of *conſcience*, and others that of *moral ſenſe*, in contradiction to *external ſenſe*, the other great and univerſal inlet of human knowledge. By this *moral ſenſe* we intuitively diſcover an eſſential difference in the *quality* of all thoughts and actions, and a general diſtinction of them into *good* and *evil*, juſt as by the *tongue* and *palate* we diſcover an eſſential difference in the *taſte* of all objects, and a general diſtinction of them into *pleaſant* and *unpleaſant*. The ableſt advocates for this inſtinctive ſyſtem agree, that the moral ſenſe is the immediate and involuntary criterion of only a few general truths, which, in their joint operation upon the mind, lay the baſis of moral obligation. Others have carried it to what we think a very dangerous extreme; as, by affirming that we cannot prove, in regard to our moral feelings, that they are conformable to any extrinſic and eternal relations of things, they ſeem to wiſh that reaſon were baniſhed from the ſcience of ethics. Were this true, it would in many caſes be impoſſible to diſtinguiſh the prejudices of early education from the pure dictates of original inſtinct, and the moſt pernicious conduct might be ſanctified with the approbation of what would be deemed the ultimate teſt of virtue and vice.

To remedy the defects of the intellectual and inſtinctive theories of morality, Mr Hume blended them together; and, upon the broader baſis of reaſon and internal ſenſe co-operating with each other, he reared a ſyſtem which, though different from thoſe of all his predeceſſors, he rendered plauſible, and ſupported with his uſual ingenuity.

16 Mr [...]ne. According to him, *ſentiment* and *reaſon* concur in almoſt all moral determinations; and he proves, that for this purpoſe "there is implanted in the human breaſt a diſintereſted principle of *benevolence* or *ſympathy*, which makes men take pleaſure in each other's happineſs. The merit or demerit of actions conſiſts wholly in their utility or natural tendency to add to the ſum of human happineſs; and the ſame he holds to be true of qualities whether bodily or mental. This utility or natural tendency it is the office of reaſon to diſcover; for that faculty alone can trace relations and conſequences. Such qualities or actions as reaſon diſcovers to be uſeful, either to the individual or to ſociety, the inſtinctive principle of benevolence makes us inſtantly approve, and this approbation conſtitutes their morality. Thus, temperance, fortitude, courage, and induſtry, &c. reaſon diſcovers to be uſeful to him who poſſeſſes them; and upon this diſcovery they are approved of by the ſentiment of ſympathy. They are therefore moral qualities, and the ſources of the *private* virtues. In like manner, generoſity, cheerfulneſs of temper, mercy, and juſtice, are diſcovered to be uſeful to ſociety; and are accompanied with the approbation of that ſentiment of ſympathy which makes every man feel a ſatisfaction in the felicity of all other men. They therefore conſtitute the *ſocial* virtues. Of every quality and every action, the merit or demerit, and of conſequence the degree of approbation or diſapprobation which is beſtowed upon it, is in exact proportion to its utility and the circumſtances of the caſe in which it occurs. The ſocial virtues are therefore greater than thoſe which are private, and one ſocial virtue is greater than another; but every quality and every action which is uſeful, either to ſociety or to the individual, is more or leſs virtuous, provided the good of the individual be conſidered as ſubordinate to the good of the public."

This theory is ingenious; and in placing the merit of actions in their utility, it furniſhes a criterion of virtue which can be employed by reaſon: but it ſeems not to be wholly free from error, and it is obviouſly defective. By pretending that the ſame ſentiment of approbation is given to uſeful actions voluntarily performed, and to uſeful qualities which are merely conſtitutional, Mr Hume confounds the merit of virtuous habits with the value of natural talents. Yet every man's conſciouſneſs will ſurely tell him, that the feeling or ſentiment which attaches to deeds of juſtice, clemency, and beneficence, is very different from that which attaches to beauty of form, ſtrength of body, vigour of mind, and mere extent of capacity. All theſe actions and qualities are uſeful; but when we approve of the former, beſides attending to their utility, we conſider them as in the man's power, and attribute the merit of them immediately to himſelf. When we approve, or rather admire, the latter on account of their utility, we know them to be not in the man's power, and we attribute the merit of them immediately to the Author of nature.

But the defects of this theory are in practice more pernicious than its errors. The author well obſerves, that the end of all moral ſpeculations is to teach us our duty; and, by proper repreſentations of the deformity of vice and beauty of virtue, to beget correſpondent habits, and engage us to avoid the one and embrace the other: but the theory under review holds out no motive ſufficient in all caſes for this purpoſe.

It is indeed true, as Mr Hume affirms, that the virtues which are immediately uſeful or agreeable to the perſon poſſeſſed of them, are deſirable in a view to ſelf-intereſt, and that a regard to ſelf-intereſt ought to engage us in their purſuit. It is likewiſe true, that the virtues which are *uſeful* and *agreeable* to others, are generally more deſirable than the contrary qualities: for as by the conſtitution of our nature no enjoyment is ſincere without ſome reference to company and ſociety; ſo no ſociety can be agreeable, or even tolerable, where a man feels his preſence unwelcome, and diſcovers all around him ſymptoms of diſguſt and averſion. Theſe conſiderations he deems ſufficient to enforce the duties of humanity, clemency, and beneficence; but he ſtates a caſe himſelf, in which they would certainly fail to make a man abſtain from his neighbour's property. The greater part of property he conſiders, and rightly conſiders, as having its foundation in human laws, which are ſo calculated as to preſerve the peace and promote the general good of the ſociety, at the unavoidable expence ſometimes of the individual. Now, in particular incidents, a ſenſible knave, by ſecretly purloining from the hoards of a worthleſs miſer, might make himſelf comfortable and independent for life, without cauſing any breach in the ſocial union, and even without hurting a ſingle individual. What then ſhould hinder him from acting thus? His ſelf-intereſt would be promoted; and if he poſſeſſed a generous ſpirit, he might gratify his ſentiment of benevolence or ſympathy by doing good with his money to the poor, which the miſer never did. For enforcing the uniform practice of juſtice in ſuch caſes as this, Mr Hume's theory of morals contains no adequate motive; but a very

 ſufficient

ſufficient one is held out by the ſyſtem which we are now to conſider.

17 A ſyſtem of ethics built upon religion.

That ſyſtem, which ſeems to have been unknown to the ancients, is built upon religion, of which indeed it conſtitutes a very eſſential part; and thoſe by whom it has been taught, maintain that no other foundation is ſufficient to bear a regular ſuperſtructure of practical ethics. The philoſophers of this ſchool (D) define virtue to be "the doing good to mankind, in obedience to the will of God, and for the ſake of everlaſting happineſs:" So that with them "the good of mankind" is the *ſubject*, "the will of God" the *criterion* or *rule*, and "everlaſting happineſs" the *motive*, of human virtue. The moral ſenſe, ſuppoſing it real, they conſider as a very inadequate rule of conduct, as being in many caſes difficult to be diſtinguiſhed from prejudice; and many of them confidently deny its exiſtence. The other rules, ſuch as the *fitneſs of things*, abſtract *right*, the *truth of things*, the *law of reaſon*, &c. they conſider either as unintelligible, or as relative to ſome end by which the rules muſt themſelves be tried. The two great queſtions, which in the ſyſtem of theſe religious philoſophers demand ſolution, are: 1*ſt*, By what means ſhall a man in every caſe diſcover preciſely what is the will of God? and, 2*dly*, What evidence have we that there will be a future ſtate of retribution and of everlaſting happineſs?

Of theſe two queſtions, the latter belongs wholly to religion; and to ſolve it they call in the aid of revelation, as well as of that which is called the religion of nature. The former queſtion is in the province of morality; and to find anſwers to it which will apply to every caſe, is the whole buſineſs of their ſyſtem.

The will of God reſpecting human conduct may be diſcovered by reaſoning *à priori* from his exiſtence and attributes, or *à poſteriori* from the tendency of his works. Being himſelf independent and all-perfect, it is inconceivable that his view in creating the world could be any thing elſe than to communicate ſome portion of his own felicity. (See METAPHYSICS, n°312.) This concluſion is agreeable to what we perceive of his works, in which there are a thouſand contrivances, all tending to give happineſs to man, and to all animated nature; and not one of which the natural tendency is to inflict pain, or prove ultimately injurious. Mankind are linked together by various ties, and made to depend in a great meaſure upon each other's conduct. That conduct, therefore, which is naturally productive of the greateſt ſum of human happineſs, muſt be agreeable to the will of God; or, in other words, virtuous conduct. That, of which the natural tendency is the reverſe, muſt be vicious; and that conduct, if there be any ſuch, which tends to produce neither happineſs nor miſery, muſt be indifferent, i. e. neither morally good nor morally evil. It is to be obſerved, however, that as, previous to their own obedience or diſobedience, all men ſtand in the ſame relation to their Creator, it muſt be his will that an equal portion of the happineſs of which human nature is capable be communicated to all by whom that nature is ſhared. Whence it follows, that only ſuch conduct as, if univerſally purſued by all men in the ſame ſtation and circumſtances, would be productive of the greateſt ſum of human happineſs on the whole, can be agreeable to the will of the Creator; and that, in judging of the morality of actions, we are not to regard their immediate conſequences in any particular caſe, but their natural and ultimate tendency if performed in all caſes.

This is a criterion of virtue which differs widely from the local or occaſional utility ſet up by Mr Hume; for the particular conſequences of an action and its general tendency may often be at variance, ſo that what might in certain circumſtances be immediately uſeful, would yet be highly criminal and ultimately pernicious. The general tendency of actions, too, may be always known, and known with the utmoſt certainty: the whole of their particular conſequences can never be diſcovered. One thing, however, is evident, that if all men in their reſpective ſtations would regulate their conduct by the natural tendency of every action, the *particular* and *general* conſequences of their conduct would be the ſame, and the greateſt happineſs would reſult from it of which human nature is in this world capable. And therefore, ſince it is only through the perverſeneſs of ſome perſon or perſons concerned, that the *particular conſequences* of any action, of which the *natural tendency* is to produce *miſery*, can ever bring *happineſs* to a ſingle individual; it can no more be the will of God that we make theſe *occaſional* and *diſtorted* conſequences the rule of our conduct, than it can be his will that the *vices* of other men ſhould be the baſis of our *virtues*. According to this ſcheme of morals, which reſts all obligation on private happineſs, the whole difference between an act of *prudence* and an act of *duty*, is this: That in the former caſe we conſider only what we ſhall gain or loſe in this world; in the latter, what we ſhall gain or loſe in the world to come.

Although the patrons of this theory queſtion the reality of the moral ſenſe as an inſtinct, they allow that a ſentiment of approbation or diſapprobation of actions, according as they are virtuous or vicious, is generated by the aſſociating principle (ſee INSTINCT, and METAPHYSICS, n°97.); and that this ſentiment, though factitious, operates inſtantaneouſly as if it were inſtinctive. They inſiſt that our earlieſt actions are the reſult of imitation; that when we firſt begin to trace conſequences, education and the deſire of immediate enjoyment are our only guides; that as our mind expands and our knowledge increaſes, the hopes and fears of futurity become the *motives*, and the will of God the *rule* of our conduct; and that long practice in virtue, upon theſe principles, produces habits by which we go on with ſatisfaction in the ſame courſe, without looking forward, on every *particular* occaſion, to the ultimate conſequences and firſt motives of our actions. Thus do habits of juſtice, benevolence, clemency, and moral approbation, ſpring, through a proper courſe of diſcipline, out of the ſelfiſh principle; and when theſe habits are completely formed and deeply rooted, man has attained the utmoſt perfection of which he is capable in this ſtate of probation, and is fitted for another of retribution and happineſs.

That theſe philoſophers have not a juſt view of human nature, when they deny that there is any innate principle of benevolence in man, we ſhall endeavour to 19

19 Defects and excellency of the ſyſtem.

(D) GASTRELL, CUMBERLAND, PUFFENDORF, NORRIS, BERKELEY, GAY, LOW, RUTHERFORTH, SOAME JENYNS, Dr JOHNSON, Mr PALEY, and Mr GISBORNE, &c.

to show when we lay the foundation of that theory which we think deserves to be preferred to all others; but we fully agree with a candid and able writer †, who seems to consider them as under the same mistake, "that their theory of morals has no tendency to weaken the foundations of virtue; and that by the account which it gives of the rise of the social affections, it obviates many of the arguments which had formerly been urged against the selfish system." Nay, we scruple not to confess, that the mode of investigation which it employs in *all cases* to discover the will of God, may in *some cases* be necessary in any system which does not banish the use of reason from the science of ethics. On this account, as well as out of respect to the first moralist ‡ of the age, who affirms, that "it must be embraced by all who are willing to know why they act, or why they forbear, to give any reason of their conduct to themselves or to others," we shall apply it to one of those cases of social duty which Mr Hume's principle of utility could not resolve. Such an example will enable the meanest of our readers to decide between the merits of it and of the theory which we shall adopt; or, as we rather hope, it will show them that the two theories lead to the same practical conclusions.

† Stuart's Elements of the Philosophy of the Human Mind.

‡ Johnson.

Having thus given our readers a short view of the most celebrated systems of ethics which have prevailed from the earliest ages of the world to the present day, we now proceed, agreeably to our definition of the science, to trace man's duty from his nature and connections, and to show that the steady practice of virtue must terminate in his ultimate happiness.

PART I.

CHAP. I. *Of* MAN *and his* CONNECTIONS.

20 Man's infant state. MAN is born a weak, helpless, delicate creature, unprovided with food, clothing, and whatever else is necessary for subsistence or defence. And yet, exposed as the infant is to numberless wants and dangers, he is utterly incapable of supplying the *former*, or securing himself against the *latter*. But, though thus feeble and exposed, he finds immediate and sure resources in the *affection* and *care* of his parents, who refuse no labours, and forego no dangers, to nurse and rear up the tender babe. By these powerful instincts, as by some mighty chain, does nature link the *parent* to the *child*, and form the strongest *moral connection* on his part, before the child has the least apprehension of it. *Hunger* and *thirst*, with all the sensations that accompany or are connected with them, explain themselves by a language strongly expressive, and irresistibly moving. As the several senses bring in notices and informations of surrounding objects, we may perceive in the young spectator early signs of a growing *wonder* and *admiration*. Bright objects and striking sounds are beheld and heard with a sort of commotion and surprise. But, without resting on any, he eagerly passes on from object to object, still pleased with whatever is most new. Thus the *love* of *novelty* is formed, and the passion of *wonder* kept awake. By degrees he comes acquainted with the most familiar objects, his parents, his brethren, and those of the family who are most conversant with him. He contracts a *fondness* for them, is uneasy when they are gone, and charmed to see them again. These feelings become the foundation of a *moral attachment* on his side; and by this reciprocal sympathy he forms the domestic alliance with his parents, brethren, and other members of the family. Hence he becomes interested in their concerns; and feels *joy* or *grief*, *hope* or *fear*, on their account, as well as his own. As his affections now point beyond himself to others, he is denominated a *good* or *ill* creature, as he stands *well* or *ill affected* to them. These, then, are the first links of the *moral chain*; the early rudiments, or outlines, of his character; his first rude essays towards agency, freedom, manhood.

When he begins to make excursions from the nursery, and extends his acquaintance abroad, he forms 21 His childhood. a little circle of companions; engages with them in play, or in quest of adventures; and leads, or is led by them, as his genius is more or less aspiring. Though this is properly the season in which *appetite* and *passion* have the *ascendant*, yet his *imagination* and *intellectual* powers open apace; and as the various images of things pass before the mental eye, he forms variety of tastes; relishes some things, and dislikes others, as his parents, companions, and a thousand other circumstances, lead him to combine agreeable or disagreeable sets of ideas, or represent to him objects in alluring or odious lights.

As his views are enlarged, his *active* and *social* powers expand themselves in proportion; the *love of action*, of *imitation*, and of *praise*, *emulation*, *curiosity*, *docility*, *a passion for command*, and *fondness of change*.—His passions are quick, variable, and pliant to every impression; his attachments and disgusts quickly succeed each other. He compares things, distinguishes actions, judges of characters, and loves or hates them, as they appear well or ill affected to himself, or to those he holds dear. Mean while he soon grows sensible of the consequences of his own actions, as they attract applause, or bring contempt: he triumphs in the former; and is ashamed of the latter, wants to hide them, and blushes when they are discovered. By means of these powers he becomes a fit subject of culture, the moral tie is drawn closer, he feels that he is accountable for his conduct to others as well as to himself, and thus is gradually ripening for society and action.

As man advances from *childhood* to *youth*, his passions as well as perceptions take a more extensive range. 22 His youth. New senses of pleasure invite him to new pursuits; he grows sensible to the attractions of beauty, feels a peculiar sympathy with the sex, and forms a more tender kind of attachment than he has yet experienced. This becomes the cement of a *new moral relation*, and gives a softer turn to his passions and behaviour. In this turbulent period he enters more deeply into a *relish of friendship*, *company*, *exercises*, and *diversions*; the *love of truth*, of *imitation*, and of *design*, grows upon him; and as his connections spread among his neighbours, fellow-citizens, and countrymen,

Of Man and his Connections. trymen, his *thirst of praise*, *emulation*, and *social affections* grow more intense and active. Mean while, it is impossible for him to have lived thus long without having become sensible of those more august signatures of order, wisdom, and goodness, which are stamped on the visible creation; and of those strong suggestions within himself of a parent mind, the source of all intelligence and beauty; an object as well as source of that activity, and those aspirations which sometimes rouse his inmost frame, and carry him out of himself to an almighty and all-governing power: Hence arise those sentiments of *reverence*, and those affections of *gratitude*, *resignation*, and *love*, which link the soul with the Author of Nature, and form that most sublime and god-like of all connections.

23
His manhood.

Man having now reached his prime, either new passions succeed, or the old set are wound up to an higher pitch. For, growing more sensible of his connections with the public, and that particular community to which he more immediately belongs; and taking withal a larger prospect of human life, and its various wants and enjoyments; he forms more intimate friendships, grasps at power, courts honour, lays down cooler plans of interest, and becomes more attentive to the concerns of society: he enters into family connections, and indulges those charities which arise from thence. The *reigning* passions of this period powerfully prompt him to provide for the decays of life; and in it *compassion* and *gratitude* exert their influence in urging the *man*, now in full vigour, to requite the affection and care of his parents, by supplying their wants, and alleviating their infirmities.

24
Old age.

At length human life verges downwards; and *old age* creeps on apace, with its *anxiety*, *love of ease*, *interestedness*, *fearfulness*, *foresight*, and *love of offspring*. —The experience of the aged is formed to direct, and their coolness to temper, the heat of youth: the former teaches them to look back on past follies; and the latter to look forward into the consequences of things, and provide against the worst. Thus every age has its peculiar genius and set of passions corresponding to thatperiod, and most conducive to the prosperity of the rest. And thus are the *wants* of one period supplied by the *capacities* of another, and the *weaknesses* of one age tally to the *passions* of another.

25
Passions of every age.

Besides these, there are other passions and affections of a less *ambulatory* nature, not peculiar to one period, but belonging to every age, and acting more or less in every breast throughout life. Such are *self-love*, *benevolence*, *love of life*, *honour*, *shame*, *hope*, *fear*, *desire*, *aversion*, *joy*, *sorrow*, *anger*, and the like. The two first are affections of a cooler strain; one pointing to the good of the individual, the other to that of the species: *joy* and *sorrow*, *hope* and *fear*, seem to be only modifications, or different exertions, of the same *original* affections of *love* and *hatred*, *desire* and *aversion*, arising from the different circumstances or position of the object desired or abhorred, as it is present or absent. From these likewise arise other *secondary* or *occasional* passions, which depend, as to their existence and several degrees, upon the original affections being gratified or disappointed; as *anger*, *complacence*, *confidence*, *jealousy*, *love*, *hatred*, *dejection*, *exultation*, *contentment*, *disgust*, which do not form *leading* passions, but rather hold of them.

By these simple but powerful springs, whether *periodical* or *fixed*, the life of man, weak and indigent as he is, is preserved and secured, and the creature is prompted to a constant round of action, even to supply his own numerous and ever-returning *wants*, and to guard against the various *dangers* and *evils* to which he is obnoxious. By these links men are connected with each other, formed into families, drawn into particular communities, and all united as by a common league into one system or body, whose members feel and sympathise one with another. By this admirable adjustment of the constitution of *man* to his *state*, and the gradual evolution of his powers, order is maintained, society upheld, and human life filled with that variety of passion and action which at once enliven and diversify it.

26
Their joint effects.

27
The directing power.

This is a short sketch of the *principal movements* of the human mind. Yet these movements are not the whole of man; they impel to action, but do not direct it: they need a *regulator* to guide their motions, to measure and apply their forces; and accordingly they have one that naturally *superintends* and *directs* their action. We are conscious of a principle within us, which examines, compares, and weighs things; notes the differences, observes the forces, and foresees the consequences, of affections and actions. By this power we look back on past times, and forward into futurity, gather experiences, estimate the real and comparative value of objects, lay out schemes, contrive means to execute them, and settle the whole order and œconomy of life. This power we commonly distinguish by the name of *reason* or *reflection*, the business of which is not to suggest any original notices or sensations, but to canvass, range, and make deductions from them.

28
The judging or approving power.

We are intimately conscious of another principle within us, which approves of certain *sentiments*, *passions*, and *actions*, and disapproves of their contraries. In consequence of the decisions of this inward judge, we denominate some actions and principles of conduct *right*, *honest*, *good*; and others *wrong*, *dishonest*, *ill*. The former excite our *esteem*, *moral complacence*, and *affection*, immediately and originally of themselves, without regard to their consequences, and whether they affect our interest or not. The latter do as naturally and necessarily call forth our *contempt*, *scorn*, and *aversion*. That power by which we perceive this difference in affections and actions, and feel a consequent relish or dislike, is commonly called *conscience* or the *moral sense*.

That there is such a power as this in the mind of every man of sound understanding, is a fact which cannot be controverted; but whether it be an instinctive power, or the result of early and deep-rooted associations, has been long and ably debated. The question is of importance in the science of human nature, as well as in ascertaining the standard of practical virtue; but to us it appears that the contending parties have carried their respective opinions to dangerous extremes.

When it is affirmed, as it sometimes has been, that reason has nothing to do in ethical science, but that in every possible situation our duty is pointed out and the performance of it enforced by mere sentiment, the consequence seems to be, that virtue and vice are nothing

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29 attempt rove we from are no ers,

thing permanent in themfelves, but change their nature according to local circumftances. Certain it is, that fentiment has in fimilar fituations approved of very different practices in different ages and different nations. At prefent this fentiment in Europe approves of the univerfal practice of juftice, and of parents protecting their children, whether well or ill formed, whether ftrong or weak: but in Sparta we know that theft, if dexteroufly practifed, was approved, and not unfrequently rewarded; and that the expofition of lame and deformed children was not only permitted, but abfolutely enjoined. There is nothing which our confcience or moral fenfe condemns with greater feverity, or views as a crime of a deeper dye, than childrens unkind treatment of their aged parents; yet there are favages, among whom inftincts of all kinds ought to prevail in greater purity than in civilized nations, whofe moral fenfe permits them to put their aged and decrepid parents to death. If this fenfe be inftinctive, and the fole judge of right and wrong, how comes it to decide fo differently on the fame line of conduct in different ages and diftant countries? The inftincts of brutes, in fimilar circumftances, prompt uniformly to fimilar actions in every age and in every region where the fpecies is found; and the external fenfes of man afford in all nations the fame unvaried evidence concerning their refpective objects. To thefe obfervations we may add, that inftincts muft be calculated for the ftate of nature, whatever that ftate may be, and therefore cannot be fuppofed capable of directing our fteps through all the labyrinths of polifhed fociety, in which duties are to be performed that in a ftate of nature would never have been thought of.

But though for thefe reafons it is apparent that mere fentiment, whether called confcience or the moral fenfe, would *alone* be a very unfafe guide to virtue in every individual cafe that may occur, we think that thofe who refolve all fuch fentiment into habit and the effect of education, without giving any part of it to nature, advance an opinion which is equally ill-founded and not lefs dangerous. There are, indeed, men who affirm that all benevolence is hypocrify, friendfhip a cheat, public fpirit a farce, fidelity a fnare to procure truft and confidence; and that while all of us at bottom purfue only our private intereft, we wear thofe fair difguifes, in order to put thofe off their guard with whom we have to deal, and to expofe them the more to our wiles and machinations. Others again, too virtuous to accufe themfelves and all mankind of direct knavery, yet infift, that whatever affection one may feel, or imagine he feels, for others, no paffion is or can be difinterefted; that the moft generous friendfhip, however fincere, is only a modification of felf-love; and that even unknown to ourfelves we feek only our own gratification, while we appear the moft deeply engaged in fchemes for the liberty and happinefs of mankind.

Surely the mildeft of thefe reprefentations is an exaggerated picture of the felfifhnefs of man. Self-love is indeed a very powerful as well as an effential principle in human nature; but that we have likewife an inftinctive principle of benevolence, which, without any particular regard to our own intereft, makes us feel pleafure in the happinefs of other men, is a fact which we think admits of very complete proof. For, as Mr Hume well argues, "when a man grieves for a friend who could be of no fervice to him, but on the contrary ftood in need of his conftant patronage and protection, how is it poffible to fuppofe that fuch paffionate tendernefs arifes from felf-intereft, which has no foundation in nature? What intereft (afks the fame deep thinker) can a fond mother have in view, who lofes her health by her affiduous attendance on her fick child, and afterwards languifhes and dies of grief when freed by its death from the flavery of attendance?—Have we no fatisfaction (continues he) in one man's company above another's, and no defire of the welfare of our friend, even though abfence or death fhould prevent us from all participation in it? Or what is it commonly that gives us any participation in it, even while alive and prefent, but our affection and regard to him?" Nor is it to contemporaries and individuals alone, that, independent of all intereft, we feel a benevolent attachment. We conftantly beftow praife on actions calculated to promote the good of mankind, though performed in ages very diftant and in countries moft remote; and he who was the author of fuch actions is the object of our efteem and affection. There is not perhaps a man alive, however felfifh in his difpofition, who does not applaud the fentiment of that emperor, who, recollecting at fupper that he had done nothing in that day for any one, exclaimed with regret, that the day had been loft! yet the utmoft fubtility of imagination can difcover no appearance of intereft that *we* can have in the generofity of *Titus*, or find any connection of our prefent happinefs with a character removed fo far from us both in time and in place. But, as Mr Hume juftly obferves, if we even feign a character confifting of all the moft generous and beneficent qualities, and give inftances in which thefe difplay themfelves, after an eminent and moft extraordinary manner, for the good of mankind, we fhall inftantly engage the efteem and approbation of all our audience, who will never fo much as inquire in what age or country the accomplifhed perfon lived.

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30 Examined and fhown

Thefe are facts which cannot be controverted; and they are wholly unaccountable, if there be not in human nature an inftinctive fentiment of benevolence or fympathy which feels a difinterefted pleafure in the happinefs of mankind. But an end in which we feel pleafure we are naturally prompted to purfue; and therefore the fame fentiment impels every man, with greater or lefs force, to promote the happinefs of other men, which by means of it becomes in reality his own good, and is afterwards purfued from the combined motives of benevolence and felf-enjoyment. For in obeying this fentiment we all feel an inward *complacency*, *felf-approbation*, or confcioufnefs of *worth* or *merit*; and in difobeying it, which cannot be done but with reluctance, we feel *remorfe*, or a confcioufnefs of *unworthinefs* or *demerit*. It appears, however, from hiftory, that the fentiment, as it is inftinctive, points only to the good of mankind, without informing us how that good is to be promoted. The means proper for this purpofe muft be difcovered by reafon; and when they are brought into view, this *fentiment*, *confcience*, or *moral fenfe*, inftantly fhows us that it is our duty to purfue them.

Hence we fee how different lines of conduct may in fimilar circumftances be approved of as virtuous in dif-

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31 To originate in the objector's mistaking the extent of those powers;

ferent nations. When the Spartan exposed his sickly and deformed child, and when the savage put his aged parents to death, neither of them erred from want of sentiment, or from having sentiments originally different from ours. Their errors resulted from a defect in reasoning. They both imagined that they were obeying the law of benevolence by preventing misery: for a weak and deformed person was very ill qualified to exist with any degree of comfort under the military constitution of Sparta, where all were soldiers, and under the necessity of undergoing the greatest hardships; and in a state where the people have no fixed habitations, and where the chace supplies even the necessaries of life, an aged and infirm person is in danger of perishing through hunger, by one of the cruellest and most lingering of deaths. The theft allowed in Sparta, if theft it may be called, was a still less deviation from the instinctive law of benevolence. Boys were taught to slip as cunningly as they could into the gardens and public halls, in order to steal away herbs or meat; and if they were caught in the fact, they were punished for their want of dexterity. This kind of theft, since it was authorised by the law and the consent of the citizens, was no robbery; and the intention of the legislator in allowing it, was to inspire the Spartan youth, who were all designed for war, with the greater boldness, subtlety, and address; to enure them betimes to the life of a soldier; and to teach them to shift for themselves, and to live upon little. That the Spartan legislator did wrong in giving his countrymen a constitution, of which successful war was the ultimate object; and that savages, rather than kill their aged parents, or suffer them to die of hunger, ought to cultivate the ground; and abandon the chace, is readily granted: but the faults of the one as well as of the other arose not from any improper decision of the moral sense, but from a defect in their reasoning powers, which were not able to estimate the advantages and disadvantages of different modes of life. In moral decisions, therefore, conscience and reason are aiding to each other. The former principle, when separated from the latter, is defective, enjoining only the good of mankind, but unable to point out the means by which it can be most effectually promoted; and the latter principle, when separated from the former, only directs a man to do what is most prudent, but cannot give him a conception of duty.

32 Which are different in nature and kind from the passions and affections.

These two powers of *reason* and *conscience* are evidently principles different in *nature* and *kind* from the passions and affections. For the passions are mere *force* or *power*, *blind impulses*, acting violently and without choice, and ultimately tending each to their respective objects, without regard to the interest of the others, or of the whole system. Whereas the *directing* and *judging* powers distinguish and ascertain the different forces, mutual proportions and relations, which the passions bear to each other and to the whole; recognise their several degrees of merit, and judge of the whole temper and conduct, as they respect either the individual or the species; and are capable of directing or restraining the blind impulses of passion in a due consistency one with the other, and a regular subordination to the whole system.

This is some account of the *constituent principles* of our nature, which, according to their different mixtures, degrees, and proportions, mould our character and sway our conduct in life. In reviewing that large train of affections which fill up the different stages of human life, we perceive this obvious distinction among them; that some of them respect the *good* of the *individual*, and others carry us beyond ourselves to the *good* of the *species* or *kind*. The former have therefore been called *private*, and the latter *public* affections. Of the first sort are *love of life*, of *pleasure*, of *power*, and the like. Of the last are *compassion*, *gratitude*, *friendship*, *natural affection*, and the like. Of the *private* passions (B), some respect merely the *security* and *defence* of the creature, such as *resentment* and *fear*; whereas others aim at some *positive* advantage or good, as *wealth*, *ease*, *fame*. The former sort, therefore, because of this difference of objects, may be termed *defensive* passions. These answer to our *dangers*, and prompt us to avoid them if we can, or boldly to encounter them when we cannot.

Of Moral Obligation.

33 Division of the passions.

34 Defensive passions.

35 Private or appetitive passions.

The other class of *private* passions, which pursue *private positive* good, may be called *appetitive*. However, we shall still retain the name of *private* in contradistinction to the *defensive* passions. Man has a great variety of wants to supply, and is capable of many enjoyments, according to the several periods of his life, and the different situations in which he is placed. To these therefore a suitable train of *private* passions correspond, which engage him in the pursuit of whatever is necessary for his subsistence or welfare.

36 Public passions.

Our *public* or *social* affections are adapted to the several *social connections* and *relations* which we bear to others, by making us sensible of their dangers, and interesting us in their wants, and so prompting us to secure them against one and supply the other.

This is the first step then to discover the *duty* and *destination* of man, the having analysed the principles of which he is composed. It is necessary, in the next place, to consider in what *order*, *proportion*, and *measure* of those inward principles, *virtue*, or a sound moral temper and right conduct, consists; that we may discover whence *moral obligation* arises.

Chap. II. *Of* Duty, *or* Moral Obligation.

37 The measure of powers.

It is by the end or design of any power or movement that we must direct its motions, and estimate the degree of force necessary to its just action. If it want the force requisite for the obtaining its end, we reckon it defective; if it has too much, so as to be carried beyond it, we say it is overcharged; and in either case it is imperfect and ill-contrived. If it has just enough to reach the scope, we esteem it right and as it should be. Let us apply this reasoning to the passions.

38 Measure of the defensive passions.

The *defence* and *security* of the individual being the *aim* of the *defensive passions*, that *security* and *defence* must be the *measure* of their *strength* or *indulgence*. If they are so *weak* as to prove insufficient for that end, or if they *carry us beyond it*, i. e. raise unnecessary commotions, or continue longer than is needful, they are unfit to answer their original design, and therefore are in an unsound and unnatural state. The exercise of *fear* or of *resentment* has nothing desirable in it, nor can

(B) Here we use passions and affections without distinction. Their difference will be marked afterwards.

M ral igation.

can we give way to either without painful sensations. Without a certain degree of them, we are naked and exposed. With too high a proportion of them, we are miserable, and often injurious to others. Thus *cowardice* or *timidity*, which is the excess of fear, instead of saving us in danger, gives it too formidable an appearance, makes us incapable of attending to the best means of preservation, and disarms us of *courage*, our natural armour. *Fool-hardiness*, which is the want of a due measure of *fear*, leads us heedlessly into danger, and lulls us into a pernicious security. *Revenge*, i. e. *excessive resentment*, by the violence of its commotion, robs us of the *presence of mind* which is often the best guard against injury, and inclines us to pursue the aggressor with more severity than self-defence requires. *Pusillanimity*, or the want of a just indignation against wrong, leaves us quite unguarded, and tends to sink the mind into a passive enervated tameness. Therefore, "to keep the defensive passions duly proportioned to our dangers, is their natural pitch and tenor."

39 sure of private ons.

The *private* passions lead us to pursue some *positive* species of *private* good: that *good* therefore which is the object and end of each must be the measure of their respective force, and direct their operation. If they are too *weak* or *sluggish* to engage us in the pursuit of their several objects, they are evidently *deficient*; but if they defeat their end by their *impetuosity*, then are they strained beyond the just tone of nature. Thus *vanity*, or an *excessive passion for applause*, betrays into such meannesses and little arts of popularity, as makes us forfeit the honour we so anxiously court. On the other hand, *a total indifference about the esteem of mankind*, removes a strong guard and spur to virtue, and lays the mind open to the most abandoned prosecutions. Therefore, "to keep our private passions and desires proportioned to our *wants*, is the just measure and pitch of this class of affections."

40 para- force.

The *defensive* and *private* passions do all agree in general, in their tendency or conduciveness to the interest or good of the individual. Therefore, when there is a collision of interest, as may sometimes happen, that *aggregate of good* or *happiness*, which is composed of the particular goods to which they respectively tend, must be the common standard by which their *comparative degrees* of strength are to be measured: that is to say, if any of them, in the degree in which they prevail, are incompatible with the greatest aggregate of good or most extensive interest of the individual, then are they unequal and disproportionate. For in judging of a particular *system* or *constitution* of powers, we call that the *supreme* or *principal* end in which the aims of the several parts or powers coincide, and to which they are subordinate; and reckon them in due proportion to each other, and right with regard to the whole, when they maintain that subordination of subserviency. Therefore, "to proportion our defensive and private passions in such measure to our dangers and wants as best to secure the individual, and obtain the greatest aggregate of private good or happiness, is their just balance or comparative standard in case of competition."

1 sure of ublic ions.

In like manner as the *public* or *social* affections point at the good of others, that *good* must be the measure of their force. When a particular *social* affection, as *gratitude* or *friendship*, which belongs to a particular *social connection*, viz. that of a *benefactor* or of a *friend*, is too feeble to make us act the *grateful* or *friendly* part, that affection, being insufficient to answer its end, is *defective* and *unsound*. If, on the other hand, a particular passion of this class counteract or defeat the interest it is designed to promote, by its violence or disproportion, then is that passion *excessive* and *irregular*. Thus *natural affection*, if it degenerates into a *passionate* fondness, not only hinders the parents from judging coolly of the interest of their offspring, but often leads them into a most partial and pernicious indulgence.

Of Moral Obligation.

As every kind affection points at the good of its particular object, it is possible there may be sometimes a collision of interests or goods. Thus the regard due to a *friend* may interfere with that which we owe to a *community*. In such a competition of interests, it is evident that the *greatest* is to be chosen; and that is the greatest interest which contains the greatest sum or aggregate of public good, greatest in *quantity* as well as *duration*. This then is the *common standard* by which the respective forces and subordinations of the social affections must be adjusted. *Therefore* we conclude, that "this class of affections are sound and regular when they prompt us to pursue the *interest* of *individuals* in an entire consistency with the *public good*;" or, in other words, "when they are duly proportioned to the *dangers* and *wants* of others, and to the various *relations* in which we stand to *individuals* or to *society*." 42 Collision of social affections.

Thus we have found, by an induction of particulars, the *natural pitch* or *tenor* of the *different orders of affection*, considered apart by themselves. Now, as the *virtue* or *perfection* of every creature lies in following its nature, or acting suitably to the just proportion and harmony of its several powers; therefore, "the VIRTUE of a creature endowed with such affections as *man* must consist in observing or acting agreeably to their *natural pitch and tenor*."

But as there are no independent affections in the fabric of the mind, no passion that stands by itself, without some relation to the rest, we cannot pronounce of any one, considered APART, that it is either *too strong* or *too weak*. Its strength and just proportion must be measured not only by its subserviency to its own immediate end, but by the respect it bears to the whole system of affection. Therefore, we say a passion is *too strong*, not only when it defeats its own end, but when it impairs the force of other passions, which are equally necessary to form a *temper of mind* suited to a certain *œconomy* or *state*; and too weak, not merely on account of its insufficiency to answer its end, but because it cannot sustain its *part* or *office* in the balance of the whole system. Thus the *love of life* may be *too strong* when it takes from the *regard* due to one's country, and will not allow one bravely to encounter dangers, or even death, on its account. Again, the *love of fame* may be *too weak* when it throws down the fences which render virtue more secure, or weakens the incentives which make it more active and public spirited. 43 Balance of affection.

If it be asked, "How far may the affections towards private good or happiness be indulged?" One limit was before fixed for the particular indulgence of each, viz. their subordination to the common aggregate of good to the private system. In these therefore a due 44 Limits of private affections.

Of Moral Obligation.

regard is always ſuppoſed to be had to *health, reputation, fortune*, the *freedom of action*, the *unimpaired exerciſe of reaſon*, the *calm enjoyment of one's ſelf*, which are all private goods. Another limit now reſults from the balance of affection juſt named, *viz.* "The ſecurity and happineſs of others;" or, to expreſs it more generally, "a *private* affection may be ſafely indulged, when, by that indulgence, we do not violate the obligations which reſult from our higher relations or public connections." A juſt reſpect therefore being had to theſe boundaries which nature has fixed in the breaſt of every man, what ſhould limit our purſuits of private happineſs? Is nature ſullen and penurious? or, does the God of nature envy the happineſs of his offſpring?

45 Colliſion of intereſts.

Whether there is ever a real colliſion of intereſts between the *public* and *private* ſyſtem of affections, or the ends which each claſs has in view, will be afterwards conſidered; but where there is no colliſion, there is little or no danger of carrying either, but eſpecially the *public* affections, to exceſs, provided both kinds are kept ſubordinate to a diſcreet and cool *ſelf-love*, and to a calm and univerſal *benevolence*, which principles ſtand as guards at the head of each ſyſtem.

46 Reſult.

This then is the conduct of the paſſions, conſidered as *particular* and *ſeparate* forces, carrying us out to their reſpective ends; and this is their balance or œconomy, conſidered as *compound* powers, or powers mutually related, acting in conjunction towards a *common* end, and conſequently as forming a *ſyſtem* or *whole*.

47 Subordination of powers.

Now, whatever adjuſts or maintains this *balance*, whatever in the human conſtitution is formed for *directing* the paſſions ſo as to keep them from defeating their own end or interfering with each other, muſt be a principle of a *ſuperior* nature to them, and *ought* to direct their meaſures and govern their proportions. But it was found that *reaſon* or reflection is ſuch a principle, which points out the tendency of our paſſions, weighs their influence upon private and public happineſs, and ſhows the beſt means of attaining either. It having been likewiſe found that there is another directing or controling principle, which we call CONSCIENCE or the MORAL SENSE, which, by a native kind of authority, judges of affections and actions, pronouncing ſome *juſt* and *good*, and others *unjuſt* and *ill*; it follows, that the paſſions, which are mere impulſe or blind forces, are principles inferior and ſubordinate to this *judging* faculty. Therefore, if we would follow the order of nature, *i. e.* obſerve the mutual reſpects and the ſubordination which the different parts of the human conſtitution bear one to another, the paſſions ought to be ſubjected to the direction and authority of the *leading* or *controling* principles.

48 In what it conſiſts.

We conclude, therefore, from this *induction*, that "the *conſtitution* or *juſt œconomy* of *human nature* conſiſts in a regular *ſubordination* of the *paſſions* and *affections* to the *authority* of *conſcience* and the *direction* of *reaſon*."

49 Oeconomy of nature, or right temper.

That *ſubordination* is *regular*, when the proportion formerly mentioned is maintained; that is to ſay, "when the *defenſive* paſſions are kept proportioned to our *dangers*; when the *private* paſſions are proportioned to our *wants*; and when the *public* affections are adapted to our *public connections*, and proportioned to the wants and dangers of others."

But the *natural ſtate*, or the *ſound* and *vigorous conſtitution* of any creature, or the *juſt œconomy* of its powers, we call its *health* and *perfection*; and the acting agreeably to theſe, its *virtue* or *goodneſs*. Therefore, "the *health* and *perfection* of man muſt lie in the aforeſaid *ſupremacy* of *conſcience* and *reaſon*, and in the *ſubordination* of the paſſions to their *authority* and *direction*. And his *virtue* or *goodneſs* muſt conſiſt in acting agreeably to that *order* or *œconomy*."

50 Human virtue a[nd] perfecti[on]

51 How co[n]formabl[e] to reaſo[n]

That ſuch an ornament of the mind, and ſuch a conduct of its powers and paſſions, will ſtand the teſt of *reaſon*, cannot admit of any diſpute. For, upon a fair examination into the conſequences of things, or the relations and aptitudes of *means* to *ends*, *reaſon* evidently demonſtrates, and *experience* confirms it, that, "to have our *defenſive paſſions* duly proportioned to our *dangers*, is the ſureſt way to avoid or get clear of them, and obtain the ſecurity we ſeek after.—To proportion our *private paſſions* to our *wants*, is the beſt means to ſupply them;—and, to adapt our *public affections* to our *ſocial relations*, and the *good* of others, is the moſt effectual method of fulfilling *one*, and procuring the *other*." In this ſenſe, therefore, *virtue* may be ſaid to be a "*conduct* conformable to *reaſon*," as reaſon diſcovers an apparent *aptitude*, in ſuch an *order* and *economy* of powers and paſſions, to anſwer the end for which they are *naturally* formed.

52 Connec[tion] betwee[n af]fection[s and] ends, n[ot] the idea [of] moral o[bli]gation.

If the idea of *moral obligation* is to be deduced merely from this *aptitude* or *connection* between certain paſſions, or a certain order and balance of paſſions, and certain ends obtained or to be obtained by them, then is *reaſon* or *reflection*, which perceives that aptitude or connection, the proper judge of *moral obligation*; and on this ſuppoſition it may be defined, as hath been done by ſome, the connection between the *affection* and the *end*, or, which is the ſame thing, between the *action* and the *motive*; for the *end* is the *motive* or the *final cauſe*, and the *affection* is the *action*, or its immediate natural cauſe. A man, from mere ſelf-love, may be induced to fulfil that obligation which is founded on the connection between the *defenſive* paſſions and their *ends*, or the *private* paſſions and their *ends*; becauſe in that caſe his own intereſt will prompt him to indulge them in the due proportion required. But if he has no affections which point beyond himſelf, no principle but *ſelf-love*, or ſome ſubtle modification of it, what ſhall intereſt him in the happineſs of others, where there is no connection between it and his own? or what ſenſe can he have of *moral obligation* to promote it? Upon this ſcheme, therefore, without public or ſocial affection there could be no *motive*, and conſequently no moral obligation, to a beneficent diſintereſted conduct.

But if the mere connection between certain paſſions, or a certain order of paſſions and certain ends, are what conſtitutes or gives us the idea of *moral obligation*, then why may not the appoſiteneſs of any temper or conduct, nay, of any piece of machinery, to obtain its end, form an equally ſtrict *moral obligation*? for the connection and aptitude are as ſtrong and invariable in the latter inſtances as in the former. But as this is confounding the moſt obvious differences of things, we muſt trace the idea of *moral obligation* to another and a more natural ſource.

53 Idea of[...] from e[xpe]rience.

Let us appeal, therefore, to our inmoſt ſenſe and experience, "how we ſtand affected to thoſe different"

Moral ation. ſets of paſſions, in the juſt meaſure and balance of which we found a right temper to conſiſt." For this is entirely a matter of experience, in which we muſt examine, as in any other natural inquiry, "what are the genuine feelings and operations of nature, and what affections or ſymptoms of them appear in the given inſtance."

54 the nſive ons ap- ved. The defenſive paſſions, as *anger* and *fear*, give us rather pain than pleaſure, yet we cannot help feeling them when provoked by injury, or expoſed to harm. We account the creature imperfect that wants them, becauſe they are neceſſary to his defence. Nay, we ſhould in ſome meaſure condemn ourſelves, did we want the neceſſary degree of *reſentment* and *caution*. But if our *reſentment* exceeds the wrong received, or our *caution* the evil dreaded, we then blame ourſelves for having over-acted our part. Therefore, while we are in danger, to be totally deſtitute of them we reckon a *blameable defect*, and to feel them in a juſt, *i. e.* neceſſary meaſure, we *approve*, as ſuited to the nature and condition of ſuch a creature as man. But our ſecurity obtained, to continue to indulge them, we not only *diſapprove* as *hurtful*, but *condemn* as *unmanly*, *unbecoming*, and *mean-ſpirited*: Nor will ſuch a conduct afford any ſelf-approving joy when we coolly reflect upon it.

55 y the ate. With regard to the *private* paſſions, ſuch as *love of life*, *pleaſure*, *eaſe*, and the like, as theſe aim at private good, and are neceſſary to the perfection and happineſs of the individual, we ſhould reckon any creature *defective*, and even *blameable*, that was deſtitute of them. Thus, we condemn the man who imprudently ruins his fortune, impairs his health, or expoſes his life; we not only pity him as an unfortunate creature, but feel a kind of *moral indignation* and contempt of him, for having made himſelf ſuch. On the other hand, though a diſcreet ſelf-regard does not attract our eſteem and veneration, yet we approve of it in ſome degree, in an higher and different degree from what we would regard a well-contrived machine, as neceſſary to conſtitute a finiſhed creature, nay, to complete the virtuous character, as exactly ſuited to our preſent indigent ſtate. There are ſome paſſions reſpecting private good, towards which we feel higher degrees of approbation, as the *love of knowledge*, of *action*, of *honour*, and the like. We eſteem them as marks of an ingenious mind; and cannot help thinking the character in which they are wanting remarkably ſtupid, and in ſome degree *immoral*.

56 y the lic. With regard to the ſocial affections, as *compaſſion*, *natural affection*, *friendſhip*, *benevolence*, and the like, we approve, admire, and love them in ourſelves, and, in all in whom we diſcover them, with an eſteem and approbation, if not different in kind, yet ſurely far ſuperior in degree, to what we feel towards the other paſſions. Theſe we reckon neceſſary; juſt, and excellently fitted to our ſtructure and ſtate; and the creature which wants them we call defective, ill-conſtituted, a kind of abortion. But the *public* affections we eſteem as ſelf-worthy, originally and eternally amiable.

57 inction ween ve- ent and n affec- s. But among the *ſocial* affections we make an obvious and conſtant diſtinction, viz. between thoſe particular paſſions which urge us with a ſudden violence, and uneaſy kind of ſenſation, to purſue the good of their reſpective objects, as *pity*, *natural affection*, and the like; and thoſe calm diſpaſſionate affections and deſires which prompt us more ſteadily and uniformly to promote the happineſs of others. The former we generally call *paſſions*, to diſtinguiſh them from the other ſort, which go more commonly by the name of *affections*, or *calm deſires*. The firſt kind we approve indeed, and delight in; but we feel ſtill higher degrees of approbation and moral complacence towards the *laſt*, and towards all limitation of the particular inſtincts, by the principle of *univerſal benevolence*. The more objects the calm affections take in, and the worthier theſe are, their dignity riſes in proportion, and with this our approbation keeps in exact pace. A character, on the other hand, which is quite diveſted of theſe public affections, which feels no love for the ſpecies, but inſtead of it entertains malice, rancour, and ill-will, we reckon totally immoral and unnatural. Of Moral Obligation.

Such then are the ſentiments and diſpoſitions we feel when theſe ſeveral orders of affection paſs before the mental eye.

Therefore, "that ſtate in which we feel ourſelves moved, in the manner above deſcribed, towards thoſe affections and paſſions, as they come under the mind's review, and in which we are, inſtantaneouſly and independently of our choice or volition, prompted to a *correſpondent* conduct, we call a ſtate of *moral obligation*." Let us ſuppoſe, for inſtance, a parent, a friend, a benefactor, reduced to a condition of the utmoſt indigence and diſtreſs, and that it is in our power to give them immediate relief. To what conduct are we *obliged?* what *duty* does nature dictate and require in ſuch a caſe? Attend to nature, and nature will tell, with a voice irreſiſtibly audible and commanding to the *human heart*, with an authority which no man can ſilence without being ſelf-condemned, and which no man can elude but at his peril, "that immediate relief *ought* to be given." Again, let a friend, a neighbour, or even a ſtranger, have lodged a *depoſit* in our hands, and after ſome time reclaim it; no ſooner do theſe ideas of the confidence repoſed in us, and of property not *transferred*, but *depoſited*, occur, than we immediately and unavoidably feel and recognize the *obligation* to reſtore it. In both theſe caſes we ſhould condemn and even loathe ourſelves if we acted otherwiſe, as having done, or omitted doing, what we *ought* not, as having acted beneath the dignity of our nature;—contrary to our moſt intimate ſenſe of *right* and *wrong*:—we ſhould accuſe ourſelves as guilty of ingratitude, injuſtice, and inhumanity,—and be conſcious of deſerving the cenſure, and therefore dread the reſentment, of all rational beings.—But in complying with the *obligation*, we feel joy and ſelf-approbation,—are conſcious of an inviolable harmony between our nature and duty, and think ourſelves intitled to the applauſe of every impartial ſpectator of our conduct.

To *deſcribe* therefore what we cannot perhaps *define*, a ſtate of *moral obligation* is "that ſtate in which a creature, endued with ſuch ſenſes, powers, and affections as man, would condemn himſelf, and think he deſerved the condemnation of all others, ſhould he refuſe to fulfil it; but would approve himſelf, and expect the approbation of all others, upon complying with it." 58 Moral obligation.

And

Of Moral Obligation.

59 Moral agent.

And we call him a MORAL AGENT, who is in ſuch a *ſtate*, or is ſubject to *moral obligation*. Therefore, as man's *ſtructure* and *connections* often ſubject him to ſuch a ſtate of *moral obligation*, we conclude that *he* is a *moral agent*. But as man may ſometimes act without *knowing* what he does, as in caſes of *frenzy* or *diſeaſe*, or in many *natural functions;* or, knowing what he does, he may act without *choice* or *affection*, as in caſes of *neceſſity* or *compulſion;* therefore to denominate an

60 Moral action good and bad.

action *moral*, i. e. *approveable*, or *blameable*, it muſt be done *knowingly* and *willingly*, or *from affection* and *choice*. "A *morally good action*, then, is to fulfil a *moral obligation* knowingly and willingly." And a *morally bad action*, or an *immoral action*, is, "to violate a *moral obligation* knowingly and willingly."

61 Moral character and temper good and bad.

As not an *action*, but a *ſeries of actions*, conſtitute a *character;* as not an *affection*, but a *ſeries of affections*, conſtitute a *temper;* and as we denominate things by the groſs, *à fortiori*, or by the qualities which chiefly prevail in them; therefore we call that a "*morally good character*, in which a *ſeries of morally good actions* prevail;" and that a "*morally good temper*, in which a *ſeries of morally good affections* have the aſcendant." A bad character and bad temper are the reverſe. But where the above mentioned *order* or *proportion* of paſſions is maintained, there a *ſeries* of *morally* good *affections and actions* will prevail. *Therefore*, "to maintain that order and proportion, is to have a *morally good temper and character*." But a "morally good temper and character is *moral rectitude*, *integrity*, *virtue*, or the *completion of duty*."

62 How we come by the idea of moral obligation.

If it be aſked, after all, "how we come by the idea "of *moral obligation* or *duty?*" we may anſwer, That we come by it in the ſame way as by our other *original* and *primary* perceptions. We receive them all from nature, or the great Author of nature. For this idea of *moral obligation* is not a creature of the mind, or dependent on any previous act of volition; but ariſes on certain occaſions, or when certain other ideas are preſented to the mind, as neceſſarily, inſtantaneouſly, and unavoidably, as *pain* does upon too near an approach to the fire, or *pleaſure* from the fruition of any good. It does not, for inſtance, depend on our choice, whether we ſhall feel the *obligation* to ſuccour a diſtreſſed parent, or to reſtore a depoſit intruſted to us when it is recalled. We cannot call this a *compound idea* made up of one or more ſimple ideas. We may indeed, nay we muſt, have ſome ideas antecedent to it, *e. g.* that of a parent—in diſtreſs—of a child—able to relieve—of the relation of one to the other—of a truſt—of right, &c. But none of theſe ideas conſtitute the perception of *obligation*. This is an idea quite diſtinct from, and ſomething ſuperadded to, the ideas of the correlatives, or the relation ſubſiſting between them. Theſe indeed, by a law of our nature, are the occaſion of ſuggeſting it; but they are as totally different from it as colours are from ſounds. By ſenſe of reflection we perceive the correlatives; our memory recals the favours or depoſit we received; the various circumſtances of the caſe are matters of fact or experience; but ſome delicate inward *organ* or *power*, or call it what we pleaſe, does, by a certain inſtantaneous ſympathy, antecedent to the cool deductions of reaſon, and independent of previous inſtruction, art, or volition, *perceive the moral harmony*, the *living*, *irreſiſtible charms of moral obligation*, which immediately intereſts the correſpondent paſſions, and prompts us to fulfil its lawful dictates.

Of Perception and Affection.

63 The uſe of reaſon in moral c[...]

We need not apprehend any danger from the quickneſs of its deciſions, nor be frightened becauſe it looks like *inſtinct*, and has been called ſo. Would we approve one for deliberating long, or reaſoning the matter much at leiſure, whether he ſhould relieve a diſtreſſed parent, feed a ſtarving neighbour, or reſtore the truſt committed to him? ſhould we not ſuſpect the reaſoner of knavery, or of very weak affections to virtue? We employ *reaſon*, and worthily employ it, in examining the condition, relations, and other circumſtances of the agent or patient, or of thoſe with whom either of them are connected, or, in other words, the *ſtate of the caſe:* and in complicated caſes, where the circumſtances are many, it may require no ſmall attention to find the true ſtate of the caſe; but when the relations of the agent or patient, and the circumſtances of the action are obvious, or come out ſuch after a fair trial, we ſhould ſcarce approve him who demurs on the obligation to that conduct which the caſe ſuggeſts.

64 Pleaſure not the [...] of obligation.

From what has been ſaid, it is evident, that it is not the pleaſure or agreeable ſenſations which accompany the exerciſe of the ſeveral affections, nor thoſe conſequent to the actions, that conſtitute *moral obligation*, or excite in us the idea of it. That pleaſure is poſterior to the idea of obligation; and frequently we are obliged, and acknowledge ourſelves under an obligation, to ſuch affections and actions as are attended with pain; as in the trials of virtue, where we are obliged to ſacrifice private to public good, or a preſent pleaſure to a future intereſt. We have pleaſure in ſerving an aged parent, but it is neither the perception nor proſpect of that pleaſure which gives us the idea of obligation to that conduct.

CHAP. III. *The* FINAL *Cauſes of our moral Faculties of* PERCEPTION *and* AFFECTION.

65 The [...] propoſed.

WE have now taken a *general* proſpect of MAN and of his *moral powers* and *connections*, and on theſe erected a ſcheme of *duty*, or *moral obligation*, which ſeems to be confirmed by *experience*, conſonant to *reaſon*, and approved by his moſt inward and moſt ſacred *ſenſes*. It may be proper in the next place to take a more particular view of the *final cauſes* of thoſe delicate *ſprings* by which he is *impelled* to action, and of thoſe *clogs* by which he is reſtrained from it. By this detail we ſhall be able to judge of their aptitude to anſwer their end, in a creature endued with his *capacities*, ſubject to his *wants*, expoſed to his *dangers*, and ſuſceptible of his *enjoyments;* and from thence we ſhall be in a condition to pronounce concerning the *end* of his *whole ſtructure*, its *harmony* with its *ſtate*, and conſequently its ſubſerviency to anſwer the great and benevolent intentions of its author.

66 Inward anatomy of the ſyſtem of the mind.

The Supreme Being has ſeen fit to blend in the whole of things a prodigious variety of diſcordant and contrary principles, *light* and *darkneſs*, *pleaſure* and *pain*, *good* and *evil*. There are multifarious natures, *higher* and *lower*, and many intermediate ones between the wide-

rcep- and tion. wide-distant extremes. These are differently situated, variously adjusted, and subjected to each other, and all of them subordinate to the order and perfection of the whole. We may suppose *man* placed as in a centre amidst those innumerable orders of beings, by his *outward* frame drawing to the *material* system, and by his *inward* connected with the INTELLECTUAL or *moral*, and of course affected by the laws which govern both, or affected by that good and that ill which result from those laws. In this infinite variety of *relations* with which he is surrounded, and of *contingencies* to which he is liable, he feels strong attractions to the *good*, and violent repulsions or aversions to the *ill*. But as good and ill are often blended, and wonderfully complicated one with the other; as they sometimes immediately produce and run up into each other, and at other times lie at great distances, yet by means of intervening links introduce one another; and as these effects are often brought about in consequence of hidden relations and general laws, of the energy of which he is an incompetent judge; it is easy for him to mistake *good* for *evil*, and *evil* for *good*, and consequently he may be frequently attracted by such things as are destructive, or repel such as are salutary. Thus, by the tender and complicated frame of his body, he is subjected to a great variety of ills, to *sickness*, *cold*, *heat*, *fatigue*, and innumerable *wants*. Yet his knowledge is so narrow withal, and his reason so weak, that in many cases he cannot judge, in the way of investigation or reasoning, of the connections of those effects with their respective causes, or of the various latent energies of natural things.—He is therefore informed of this connection by the experience of certain *senses* or *organs* of *perception*, which, by a mechanical instantaneous motion, feel the *good* and the *ill*, receiving pleasure from *one*, and pain from the *other*. By these, without any reasoning, he is taught to attract or choose what tends to his welfare, and to repel and avoid what tends to his ruin. Thus, by his senses of *taste* and *smell*, or by the *pleasure* he receives from certain kinds of food, he is admonished which agree with his constitution; and by an opposite sense of *pain* he is informed which sort disagree, or are destructive of it; but is not by means of this instructed in the inward natures and constitutions of things.

ap- and s. Some of those senses are armed with strong degrees of *uneasiness* or *pain*, in order to urge him to seek after such objects as are suited to them. And these respect his more immediate and pressing *wants*; as the sense of *hunger*, *thirst*, *cold*, and the like; which, by their painful importunities, compel him to provide *food*, *drink*, *raiment*, *shelter*. Those instincts by which we are thus prompted with some kind of commotion or violence to attract and pursue *good*, or to repel and avoid *ill*, we call *appetites* and *passions*. By our senses then we are informed of what is *good* or *ill* to the *private system*, or the *individual*; and by our *private appetites* and *passions* we are impelled to one, and restrained from the other.

out- ate. In consequence of this machinery, and the great train of wants to which our nature subjects us, we are engaged in a continued series of occupations, which often require much application of thought, or great bodily labour, or both. The necessaries of life, food, cloaths, shelter, and the like, must be provided; conveniencies must be acquired to render life still more easy and comfortable. In order to obtain these, arts, industry, manufactures, and trade, are necessary. And to secure to us the peaceable enjoyment of their fruits, civil government, policy, and laws, must be contrived, and the various business of public life carried on: thus, while man is concerned and busied in making provision, or obtaining security for himself, he is by degrees engaged in connections with a family, friends, neighbours, a community, or a commonwealth. Hence arise new wants, new interests, new cares, and new employments. The passions of one man interfere with those of another. Interests are opposed. Competitions arise, contrary courses are taken. Disappointments happen, distinctions are made, and parties formed. This opens a vast scene of distraction and embarrassment, and introduces a mighty train of good and ill, both public and private. Yet amidst all this confusion and hurry, plans of action must be laid, consequences foreseen or guarded against, inconveniences provided for; and frequently particular resolutions must be taken, and schemes executed, without reasoning or delay. *Of Perception and Affection.*

Now what provision has the Author of our nature made for this necessitous condition? how has he fitted the actor, man, for playing his part in this perplexed and busy scene? 69 Provisions for it.

Our supreme Parent, watchful for the whole, has not left himself without a witness here neither, and hath made nothing imperfect, but all things are double one against the other. He has not left man to be informed, only by the cool notices of reason, of the *good* or *ill*, the *happiness* or *misery* of his fellow-creatures.—He has made him sensible of their good and happiness, but especially of their ill and misery, by an immediate sympathy, or quick *feeling* of *pleasure* and of *pain*. 70 By public senses and passions.

The latter we call PITY or COMPASSION. For the former, though every one, who is not quite divested of humanity, feels it in some degree, we have got not a name, unless we call it CONGRATULATION or *joyful* SYMPATHY, or that *good humour* which arises on seeing others pleased or happy. Both these feelings have been called in general the PUBLIC or COMMON SENSE, κοινη μνημοσυνη, by which we feel for others, and are interested in their concerns as really, though perhaps less sensibly than in our own. 71 Pity. 72 Congratulation.

When we see our fellow-creatures unhappy through the fault or injury of others, we feel *resentment* or *indignation* against the *unjust* causers of that misery. If we are conscious that it has happened through our fault or *injurious* conduct, we feel *shame*; and both these classes of *senses* and *passions*, regarding *misery* and *wrong*, are armed with such sharp sensations of *pain*, as not only prove a powerful guard and security to the *species*, or *public system*, against those ills it may, but serve also to lessen or remove those ills it does, suffer. Compassion draws us out of ourselves to bear a part of the misfortunes of others, powerfully solicits us in their favour, melts us at the sight of their distress, and makes us in some degree unhappy till they are relieved from it. It is peculiarly well adapted to the condition of human life, because it is much more and oftener in our power to do mischief than good, and to prevent or lessen misery than to communicate positive 73 Resentment.

Of Perception and Affection.

tive happineſs; and therefore it is an admirable reſtraint upon the more *ſelfiſh* paſſions, or thoſe violent impulſes that carry us to the hurt of others.

74 Public affections.

There are other particular *inſtincts* or *paſſions* which intereſt us in the concerns of others, even while we are moſt buſy about our own, and which are ſtrongly attractive of *good*, and repulſive of *ill* to them. Such are *natural affection*, *friendſhip*, *love*, *gratitude*, *deſire of fame*, *love of ſociety*, of *one's country*, and others that might be named. Now as the *private* appetites and paſſions were found to be armed with ſtrong ſenſations of deſire and uneaſineſs, to prompt man the more effectually to ſuſtain labours, and to encounter dangers in purſuit of thoſe goods that are neceſſary to the preſervation and welfare of the individual, and to avoid thoſe ills which tend to his deſtruction; in like manner it was neceſſary, that this *other* claſs of deſires and affections ſhould be prompted with as quick ſenſations of pain, not only to counteract the ſtrength of their antagoniſts, but to engage us in a virtuous activity for our relations, families, friends, neighbours, country. Indeed our *ſenſe* of *right* and *wrong* will admoniſh us that it is our *duty*, and *reaſon* and *experience* farther aſſure us that it is both our *intereſt* and beſt *ſecurity*, to promote the happineſs of others; but that *ſenſe*, that *reaſon*, and that *experience*, would frequently prove but weak and ineffectual prompters to ſuch a conduct, eſpecially in caſes of danger and hardſhip, and amidſt all the importunities of nature, and that conſtant hurry in which the *private* paſſions involve us, without the aid of thoſe particular *kind* affections which mark out to us particular ſpheres of duty, and with an agreeable violence engage and fix us down to them.

75 Contraſt or balance of paſſions.

It is evident, therefore, that thoſe two claſſes of affection, the *private* and *public*, are ſet one againſt the other, and deſigned to controul and limit each other's influence, and thereby to produce a juſt balance in the whole *. In general, the violent ſenſations of pain and uneaſineſs which accompany hunger, thirſt, and the other private appetites, or too great fatigue of mind as well as of body, prevent the individual from running to great exceſſes in the exerciſe of the higher functions of the mind, as too intenſe thought in the ſearch of truth, violent application to buſineſs of any kind, and different degrees of romantic heroiſm. On the other hand, the finer ſenſes of *perception*, and thoſe *generous deſires* and *affections* which are connected with them, the *love of action*, of *imitation*, of *truth*, *honour*, *public virtue*, and the like, are wiſely placed in the oppoſite ſcale, in order to prevent us from ſinking into the dregs of the *animal* life, and debaſing the dignity of man below the condition of brutes. So that, by the mutual re-action of thoſe oppoſite powers, the bad effects are prevented that would naturally reſult from their acting ſingly and apart, and the good effects are produced which each are ſeverally formed to produce.

* Vid. *Hutcheſon's Conduct of the Paſſions*, *treat.* 1. § 2.

76 Contraſt or balance of public and private paſſions.

The ſame wholeſome oppoſition appears likewiſe in the particular counter-workings of the *private* and *public* affections one againſt the other. Thus *compaſſion* is adapted to counterpoiſe the *love of eaſe*, of *pleaſure*, and of *life*, and to diſarm or to ſet bounds to *reſentment*; and *reſentment* of injury done to ourſelves, or to our friends who are dearer than ourſelves, prevents an effeminate *compaſſion* or *conſternation*, and gives us a noble contempt of labour, pain, and death. *Natural affection*, *friendſhip*, *love of one's country*, nay, *zeal* for any particular virtue, are frequently more than a match for the whole train of *ſelfiſh* paſſions. —On the other hand, without that intimate over-ruling paſſion of *ſelf-love*, and thoſe private deſires which are connected with it, the *ſocial* and *tender inſtincts* of the human heart would degenerate into the wildeſt dottage, the moſt torturing anxiety, and downright frenzy.

77 Contra[ſt] among thoſe o[f] the ſa[me] claſſes.

But not only are the different orders or claſſes of affection checks one upon another, but paſſions of the ſame claſſes are mutual clogs. Thus, how many are with-held from the violent outrages of *reſentment* by *fear?* and how eaſily is *fear* controlled in its turn, while mighty wrongs awaken a mighty *reſentment!* The *private* paſſions often interfere, and therefore moderate the violence of each other; and a calm *ſelf-love* is placed at their head, to direct, influence, and controul their particular attractions and repulſions. The *public* affections likewiſe reſtrain one the other: and all of them are put under the controul of a calm diſpaſſionate *benevolence*, which ought in like manner to direct and limit their particular motions. Thus moſt part, if not all the paſſions, have a twofold aſpect, and ſerve a twofold end. In *one* view they may be conſidered as *powers*, impelling mankind to a certain courſe, with a *force* proportioned to the *apprehended moment* of the good they aim at. In *another* view they appear as *weights*, balancing the action of the *powers*, and controuling the violence of their impulſes. By means of theſe *powers* and *weights* a natural *poiſe* is ſettled in the human breaſt by its all-wiſe Author, by which the creature is kept tolerably ſteady and regular in his courſe, amidſt that variety of ſtages through which he muſt paſs.

78 Partic[ular] percep[tions] or inſt[incts] of app[roba]tion.

But this is not all the proviſion which God has made for the hurry and perplexity of the ſcene in which man is deſtined to act. Amidſt thoſe infinite attractions and repulſions towards private and public good and ill, mankind either cannot often foreſee the *conſequences* or *tendencies* of all their actions towards one or other of theſe, eſpecially where thoſe tendencies are intricate and point different ways, or thoſe conſequences remote and complicated; or though, by careful and cool enquiry, and a due improvement of their rational powers, they might find them out, yet, diſtracted as they are with buſineſs, amuſed with trifles, diſſipated by pleaſure, and diſturbed by paſſion, they either have or can find no leiſure to attend to thoſe conſequences, or to examine how far this or that conduct is productive of private or public good on the whole. Therefore, were it left entirely to the ſlow and ſober deductions of reaſon to trace thoſe tendencies, and make out thoſe conſequences, it is evident, that in many particular inſtances the buſineſs of life muſt ſtand ſtill, and many important occaſions of action be loſt, or perhaps the groſſeſt blunders be committed. On this account, the Deity, beſides that general approbation which we beſtow on every degree of *kind* affection, has moreover implanted in man many particular *perceptions* or *determinations* to approve of certain *qualities* or *actions*, which, in effect, tend to the advantage of ſociety, and are connected with

Percep- n and ction.

with private good, though he does not always see that tendency, nor mind that connection. And these *perceptions* or *determinations* do without reasoning point out, and, antecedent to views of interest, prompt to a conduct beneficial to the *public*, and useful to the *private* system. Such is that *sense of candour and veracity*, that *abhorrence of fraud and falsehood*, that *sense of fidelity*, *justice*, *gratitude*, *greatness of mind*, *fortitude*, *clemency*, *decorum*; and that *disapprobation of knavery*, *injustice*, *ingratitude*, *meanness of spirit*, *cowardice*, *cruelty*, and *indecorum*, which are natural to the human mind. The *former* of those dispositions, and the actions flowing from them, are approved, and those of the latter kind disapproved by us, even abstracted from the view of their tendency or conduciveness to the happiness or misery of others, or of ourselves. In one we discern a *beauty*, a *superior excellency*, a congruity to the *dignity* of man; in the other a *deformity*, a *littleness*, a *debasement*, of human nature.

79 ers of nferior r.

There are other principles also connected with the good of society, or the happiness and perfection of the individual, though that connection is not immediately apparent, which we behold with real complacency and approbation, though perhaps inferior in degree, if not in kind, such as *gravity*, *modesty*, *simplicity of deportment*, *temperance*, *prudent œconomy*; and we feel some degree of contempt and dislike where they are wanting, or where the opposite qualities prevail. These and the like *perceptions* or *feelings* are either different *modifications* of the *moral sense*, or *subordinate* to it, and plainly serve the same important purpose, being expeditious *monitors*, in the several emergencies of a various and distracted life, of what is *right*, what is *wrong*, what is to be *pursued*, and what *avoided*; and, by the pleasant or painful consciousness which attends them, exerting their influence as powerful *prompters* to a suitable conduct.

80 ir gene- enden

From a slight inspection of the above-named principles, it is evident they all carry a friendly aspect to *society* and the *individual*, and have a more immediate or a more remote tendency to promote the *perfection* or *good* of both. This tendency cannot be always foreseen, and would be often mistaken or seldom attended to by a weak, busy, short-sighted creature like man, both rash and variable in his opinions, a dupe to his own passions, or to the designs of others, liable to sickness, to want, and to error. Principles, therefore, which are so nearly linked with *private security* and *public good*, by directing him, without operose reasoning, where to find *one*, and how to promote the *other*; and, by prompting him to a conduct conducive to both, are admirably adapted to the exigencies of his present state, and wisely calculated to obtain the ends of universal benevolence.

81 ions fit- to a of ;

It were easy, by considering the subject in another light, to show, in a curious detail of particulars, how wonderfully the inside of man, or that astonishing train of *moral powers* and *affections* with which he is endued, is fitted to the several stages of that *progressive* and *probationary* state through which he is destined to pass. As our faculties are narrow and limited, and rise from very small and imperfect beginnings, they must be improved by exercise, by attention, and repeated trials. And this holds true not only of our *intellectual*, but of our *moral* and *active* powers. The former are liable to errors in speculation, the latter to blunders in practice, and both often terminate in misfortunes and pains. And those errors and blunders are generally owing to our passions, or to our too forward and warm *admiration* of those partial *goods* they naturally pursue, or to our fear of those partial *ills* they naturally repel. Those misfortunes, therefore, lead us back to consider where our misconduct lay, and whence our errors flowed; and consequently are salutary pieces of trial, which tend to enlarge our views, to *correct* and *refine* our passions, and consequently improve both our *intellectual* and *moral* powers. Our passions then are the rude materials of our virtue, which Heaven has given us to work up, to refine and polish into an harmonious and divine piece of workmanship. They furnish out the whole machinery, the calms and storms, the lights and shades of human life. They show mankind in every attitude and variety of character, and give *virtue* both its struggles and its triumphs. To conduct them well in every state, is merit; to abuse or misapply them, is demerit.

Of Perception and Affection.

82 To a progressive state.

The different sets of *senses*, *powers*, and *passions*, which unfold themselves in those successive stages, are both necessary and adapted to that *rising* and *progressive* state. Enlarging views and growing connections require new passions and new habits; and thus the mind, by these continually expanding and finding a progressive exercise, rises to higher improvements, and pushes forward to maturity and perfection.

83 Harmony of our structure and state.

In this beautiful œconomy and harmony of our structure, both outward and inward, with that state we may at once discern the great lines of our duty traced out in the fairest and brightest characters, and contemplate with admiration a more august and marvellous scene of divine wisdom and goodness laid in the human breast, than we shall perhaps find in the whole compass of nature.

84 In what œconomy virtue consists.

From this detail it appears, that man, by his original frame, is made for a *temperate*, *compassionate*, *benevolent*, *active*, and *progressive* state. He is strongly *attractive* of the *good*, and *repulsive* of the *ills* which befal others as well as himself. He feels the highest *approbation* and *moral complacence* in those affections, and in those actions, which immediately and directly respect the *good* of others, and the highest *disapprobation* and *abhorrence* of the contrary. Besides these, he has many particular *perceptions* or *instincts* of *approbation*, which, though perhaps not of the same kind with the others, yet are accompanied with correspondent degrees of affection, proportioned to their respective tendencies to the *public good*. *Therefore*, by acting agreeably to these principles, *man* acts agreeably to his structure, and fulfils the benevolent intentions of its author. But we call a thing *good* when it answers its *end*, and a creature *good*, when he acts in a *conformity* to his *constitution*. Consequently, *man* must be denominated *good* or *virtuous* when he acts suitably to the *principles* and *destination* of his nature.

PART II.

CHAP. I. *The principal Diſtinctions of* DUTY *or* VIRTUE.

WE have now conſidered the *conſtitution* and *connections* of *man*, and on thoſe erected a general ſyſtem of *duty* or *moral obligation*, conſonant to *reaſon*, approved by his moſt ſacred and intimate *ſenſe*, ſuitable to his *mixed condition*, and confirmed by the *experience* of mankind. We have alſo traced the *final cauſes* of his *moral faculties* and *affections* to thoſe noble purpoſes they anſwer, with regard both to the *private* and the *public ſyſtem*.

85 General diviſion of duty.

From this induction it is evident, that there is one order or claſs of duties which *man* owes to *himſelf*: another to *ſociety*: and a third to *God*.

86 Duty to one's ſelf.

The duties he owes to *himſelf* are founded chiefly on the *defenſive* and *private* paſſions, which prompt him to purſue whatever tends to "*private good* or *happineſs*, and to avoid or ward off whatever tends to *private ill* or *miſery*. Among the various goods which allure and ſolicit him, and the various ills which attack or threaten him, "to be intelligent and accurate in ſelecting *one*, and rejecting the *other*, or in preferring the moſt *excellent goods*, and avoiding the moſt *terrible ills*, when there is a competition among either, and to be diſcreet in uſing the beſt means to attain the *goods* and avoid the *ills*, is what we call *prudence*." This, in our *inward* frame, correſponds to *ſagacity*, or *quickneſs of ſenſe*, in our *outward*.—"To proportion our *defenſive paſſions* to our *dangers*, we call *fortitude*;" which always implies "a juſt mixture of calm reſentment or animoſity, and well-governed caution." And this *firmneſs of mind* anſwers to the *ſtrength* and *muſcling* of the *body*. And "duly to adjuſt our *private paſſions* to our wants, or to the reſpective moment of the good we affect or purſue, we call *temperance*;" which does therefore always imply, in this large ſenſe of the word, "a juſt balance or command of the paſſions."

87 Duties to ſociety.

The *ſecond claſs* of *duties* ariſes from the *public* or *ſocial affections*, "the juſt harmony or proportion of which to the *dangers* and *wants* of others, and to the ſeveral *relations* we bear, commonly goes by the name of *juſtice*." This includes the whole of our duty to *ſociety*, to our *parents*, and the *general polity* of *nature*; particularly *gratitude*, *friendſhip*, *ſincerity*, *natural affection*, *benevolence*, and the other *ſocial virtues*: This, being the *nobleſt temper*, and *faireſt complection* of the ſoul, correſponds to the *beauty* and *fine proportion* of the perſon. The virtues comprehended under the former claſs, eſpecially *prudence* and *fortitude*, may likewiſe be transferred to this; and according to the various circumſtances in which they are placed, and the more confined or more extenſive ſphere in which they operate, may be denominated *private*, *œconomical*, or *civil prudence*, *fortitude*, &c. Theſe direct our conduct with regard to the *wants* and *dangers* of thoſe leſſer or greater circles with which they are connected.

The *third* claſs of duties reſpects the DEITY, and ariſes from the *public affections*, and the ſeveral glorious *relations* which he ſuſtains to us as our *creator*, *benefactor*, *lawgiver*, *judge*, &c.

We choſe to conſider this *ſet* of duties in the laſt place; becauſe, though *prior* in dignity and excellency, they ſeem to be *laſt* in order of time, as thinking it the moſt ſimple and eaſy method to follow the gradual progreſs of nature, as it takes its riſe from individuals, and ſpreads through the *ſocial* ſyſtem, and ſtill aſcends upwards, till at length it ſtretches to its almighty Parent and Head, and ſo terminates in thoſe duties which are *higheſt* and *beſt*.

The duties reſulting from theſe *relations* are, *reverence*, *gratitude*, *love*, *reſignation*, *dependence*, *obedience*, *worſhip*, *praiſe*; which, according to the model of our finite capacities, muſt maintain ſome ſort of proportion to the grandeur and perfection of the object whom we venerate, love, and obey. "This *proportion* or *harmony* is expreſſed by the general name of *piety* or *devotion*," which is always ſtronger or weaker according to the greater or leſs apprehended excellency of its object. This ſublime principle of virtue is the enlivening ſoul which animates the *moral ſyſtem*, and that cement which binds and ſuſtains the other duties which *man* owes to *himſelf* or to *ſociety*.

This then is the general temper and conſtitution of virtue, and theſe are the principal lines or diviſions of duty. To thoſe good diſpoſitions which reſpect the ſeveral objects of our duty, and to all actions which flow from ſuch diſpoſitions, the mind gives its ſanction or teſtimony. And this ſanction or judgment concerning the moral quality, or the goodneſs of actions or diſpoſitions, moraliſts call *conſcience*. When it judges of an action that is to be performed, it is called an *antecedent conſcience*; and when it paſſes ſentence on an action which is performed, it is called a *ſubſequent conſcience*. The tendency of an action to produce happineſs, or its external conformity to a law, is termed its *material* goodneſs. But the good diſpoſitions from which an action proceeds, or its conformity to law in every reſpect, conſtitutes its *formal* goodneſs.

When the mind is ignorant or uncertain about the moment of an action or its tendency to private or public good; or when there are ſeveral circumſtances in the caſe, ſome of which, being doubtful, render the mind dubious concerning the morality of the action; this is called a *doubtful* or *ſcrupulous conſcience*; if it miſtakes concerning theſe, it is called an *erroneous conſcience*. If the *error* or *ignorance* is *involuntary* or *invincible*, the action proceeding from that *error*, or from that *ignorance*, is reckoned *innocent*, or not imputable. If the error or ignorance is *ſupine* or *affected*, *i. e.* the effect of negligence, or of affectation and wilful inadvertence, the conduct flowing from ſuch error, or ſuch ignorance, is *criminal* and *imputable*.—Not to follow one's conſcience, though erroneous and ill-informed, is *criminal*, as it is the guide of life; and to counteract it, ſhows a depraved and incorrigible ſpirit. Yet to follow an erroneous conſcience is like-

wiſe criminal, if that error which miſled the conſcience was the effect of inattention, or of any criminal paſſion *.

If it be aſked, "How an erroneous conſcience ſhall be rectified, ſince it is ſuppoſed to be the only guide of life, and judge of morals?" we anſwer, in the very ſame way that we would rectify reaſon if at any time it ſhould judge wrong, as it often does, *viz.* by giving it proper and ſufficient materials for judging right, *i. e.* by inquiring into the whole ſtate of the caſe, the relations, connections, and ſeveral obligations of the actor, the conſequences and other circumſtances of the action, or the ſurpluſage of private or public good which reſults, or is likely to reſult, from the action or from the omiſſion of it. If thoſe circumſtances are fairly and fully ſtated, the conſcience will be juſt and impartial in its deciſion: for, by a neceſſary law of our nature, it approves and is well affected to the *moral form*; and if it ſeems to approve of *vice* or *immorality*, it is always under the notion or maſk of ſome *virtue*. So that, ſtrictly ſpeaking, it is not conſcience which errs; for its ſentence is always conformable to the view of the caſe which lies before it; and is *juſt*, upon the ſuppoſition that the caſe is truly ſuch as it is repreſented to it. All the fault is to be imputed to the agent, who neglects to be better informed, or who, through weakneſs or wickedneſs, haſtens to paſs ſentence from an imperfect evidence.

Chap. II. *Of Man's duty to* Himself. *Of the Nature of* Good, *and the Chief* Good.

Every creature, by the conſtitution of his nature, is determined to love himſelf; to purſue whatever tends to his preſervation and happineſs, and to avoid whatever tends to his hurt and miſery. Being endued with ſenſe and perception, he muſt neceſſarily receive *pleaſure* from ſome objects, and *pain* from others. Thoſe objects which give pleaſure are called *good;* and thoſe which give pain, *evil.* To the former he feels that attraction or motion we call *deſire*, or *love*; to the latter, that impulſe we call *averſion*, or *hatred*.—To objects which ſuggeſt neither pleaſure nor pain, and are apprehended of no uſe to procure one or ward off the other, we feel neither *deſire* nor *averſion*; and ſuch objects are called *indifferent*. Thoſe objects which do not of themſelves produce pleaſure or pain, but are the *means* of procuring either, we call *uſeful* or *noxious*. Towards them we are affected in a ſubordinate manner, or with an *indirect* and *reflective* rather than a *direct* and *immediate* affection. All the original and particular affections of our nature lead us out to and ultimately reſt in the firſt kind of objects, *viz.* thoſe which give immediate pleaſure, and which we therefore call *good*, *directly ſo*. The calm affection of *ſelf-love* alone is converſant about ſuch objects as are only *conſequentially good*, or merely uſeful to ourſelves.

But, beſides thoſe ſorts of objects which we call *good*, merely and ſolely as they give pleaſure, or are means of procuring it, there is an higher and nobler ſpecies of good, towards which we feel that peculiar movement we call *approbation* or *moral complacency*; and which we *therefore* denominate *moral good*. Such are our affections, and the conſequent actions to them. The perception of this is, as has been already obſerved, quite diſtinct in kind from the perception of other ſpecies; and though it may be connected with *pleaſure* or *advantage* by the benevolent conſtitution of nature, yet it conſtitutes a *good* independent of that pleaſure and that advantage, and far ſuperior not in degree only but in dignity to both. The *other*, *viz.* the *natural good*, conſiſts in obtaining thoſe pleaſures which are adapted to the peculiar ſenſes and paſſions ſuſceptible of them, and is as various as are thoſe ſenſes and paſſions. This, *viz.* the *moral* good, lies in the right conduct of the ſeveral ſenſes and paſſions, or their juſt proportion and accommodation to their reſpective objects and relations; and this is of a more ſimple and invariable kind. Of Man's duty to Himſelf.

96 Human happineſs.

By our ſeveral ſenſes we are capable of a great variety of pleaſing ſenſations. Theſe conſtitute diſtinct ends or objects ultimately purſuable for their own ſake. To theſe ends, or ultimate objects, correſpond peculiar appetites or affections, which prompt the mind to purſue them. When theſe ends are attained, there it reſts, and looks no farther. Whatever therefore is purſuable, not on its own account, but as ſubſervient or neceſſary to the attainment of ſomething elſe that is intrinſically valuable for its own ſake, be that value ever ſo great or ever ſo ſmall, we call a *mean*, and not an *end*. So that *ends* and *means* conſtitute the *materials* or the very *eſſence* of our *happineſs*. Conſequently happineſs, *i. e. human* happineſs, cannot be one ſimple uniform thing in creatures conſtituted, as we are, with ſuch various ſenſes of pleaſure, or ſuch different capacities of enjoyment. Now the ſame principle, or law of our nature, which determines us to purſue any one end or ſpecies of good, prompts us to purſue every other end or ſpecies of good of which we are ſuſceptible, or to which our Maker has adapted an original propenſion. But, amidſt the great multiplicity of *ends* or *goods* which form the various ingredients of our happineſs, we perceive an evident *gradation* or *ſubordination* ſuited to that gradation of *ſenſes*, *powers*, and *paſſions*, which prevails in our mixed and various conſtitution, and to that aſcending ſeries of connections which open upon us in the different ſtages of our progreſſive ſtate.

97 Gradation of goods.

Thus the goods of the *body*, or of the *external ſenſes*, ſeem to hold the loweſt rank in this gradation or ſcale of goods. Theſe we have in common with the brutes; and though many men are brutiſh enough to purſue the goods of the body with a more than brutal fury, yet, when at any time they come in competition with goods of an higher order, the unanimous verdict of mankind, by giving the laſt the preference, condemns the firſt to the meaneſt place. Goods conſiſting in exterior ſocial connections, as *fame*, *fortune*, *power*, *civil authority*, ſeem to ſucceed next, and are chiefly valuable as the means of procuring *natural* or *moral* good, but principally the latter. Goods of the *intellect* are ſtill ſuperior, as *taſte*, *knowledge*, *memory*, *judgment*, &c. The higheſt are moral goods of the mind, directly and ultimately regarding ourſelves, as *command of the appetites* and *paſſions*, *prudence*, *fortitude*, *benevolence*, &c. Theſe are the great objects of our purſuit, and the principal ingredients of our hap-

 pineſs.

pineſs. Let us conſider each of them as they riſe one above the other in this natural ſeries or ſcale, and touch briefly on our obligations to purſue them.

98 Goods of the body.

Thoſe of the body are *health*, *ſtrength*, *agility*, *hardineſs*, and *patience of change*, *neatneſs*, and *decency*.

99 Good health;

Good health, and a regular eaſy flow of ſpirits, are in themſelves ſweet natural enjoyments, a great fund of pleaſure, and indeed the proper ſeaſoning which gives a flavour and poignancy to every other pleaſure. The want of health unfits us for moſt duties of life, and is eſpecially an enemy to the ſocial and human affections, as it generally renders the unhappy ſufferer peeviſh and ſullen, diſguſted at the allotments of Providence, and conſequently apt to entertain ſuſpicious and gloomy ſentiments of its Author. It obſtructs the free exerciſe and full improvement of our reaſon, makes us a burden to our friends, and uſeleſs to ſociety. Whereas the uninterrupted enjoyment of good health is a conſtant ſource of good humour, and good humour is a great friend to openneſs and benignity of heart, enables us to encounter the various ills and diſappointments of life with more courage, or to ſuſtain them with more patience; and, in ſhort, conduces much, if we are otherwiſe duly qualified, to our acting our part in every exigency of life with more firmneſs, conſiſtency, and dignity. Therefore it imports us much to preſerve and improve an habit or enjoyment, without which every other external entertainment is taſteleſs, and moſt other advantages of little avail.—

100 How preſerved.

And this is beſt done by a ſtrict temperance in diet and regimen, by regular exerciſe, and by keeping the mind ſerene and unruffled by violent paſſions, and unſubdued by intenſe and conſtant labours, which greatly impair and gradually deſtroy the ſtrongeſt conſtitutions.

101 Strength, agility, &c.

Strength, *agility*, *hardineſs*, and *patience of change*, ſuppoſe health, and are unattainable without it; but they imply ſomething more, and are neceſſary to guard it, to give us the perfect uſe of life and limbs, and to ſecure us againſt many otherwiſe unavoidable ills.— The exerciſe of the neceſſary manual, and of moſt of the elegant arts of life, depends on ſtrength and agility of body; perſonal dangers, private and public dangers, the demands of our friends, our families, and country, require them; they are neceſſary in war, and ornamental in peace; fit for the employment of a country and a town life, and they exalt the entertainments and diverſions of both.

102 How attained.

They are chiefly obtained by moderate and regular exerciſe.

103 Patience of change;

Few are ſo much raiſed above want and dependence, or ſo exempted from buſineſs and care, as not to be often expoſed to inequalities and changes of diet, exerciſe, air, climate, and other irregularities. Now, what can be ſo effectual to ſecure one againſt the miſchiefs ariſing from ſuch unavoidable alterations, as hardineſs, and a certain verſatility of conſtitution which can bear extraordinary labours, and ſubmit to great changes, without any ſenſible uneaſineſs or bad conſequences.

104 How attained.

This is beſt attained, not by an over-great delicacy and minute attention to forms, or by an invariable regularity in diet, hours, and way of living, but rather by a bold and diſcreet latitude of regimen. Beſides, deviations from eſtabliſhed rules and forms of living, if kept within the bounds of ſobriety and reaſon, are friendly to thought and original ſentiments, animate the dull ſcene of ordinary life and buſineſs, and agreeably ſtir the paſſions, which ſtagnate or breed ill-humour in the calms of life.

105 Neatneſs, decency, &c.

Neatneſs, *cleanlineſs*, and *decency*, to which we may add *dignity* of *countenance*, and *demeanour*, ſeem to have ſomething refined and moral in them: at leaſt we generally eſteem them indications of an orderly, genteel, and well-governed mind, conſcious of an inward worth, or the reſpect due to one's nature. Whereas *naſtineſs*, *ſlovenlineſs*, *aukwardneſs*, and *indecency*, are ſhrewd ſymptoms of ſomething mean, careleſs, and deficient, and betray a mind untaught, illiberal, unconſcious of what is due to one's ſelf or to others. How much cleanlineſs conduces to health, needs hardly to be mentioned; and how neceſſary it is to maintain one's character and rank in life, and to render us agreeable to others as well as to ourſelves, is as evident.—There are certain motions, airs, and geſtures, which become the human countenance and form, in which we perceive a *comelineſs*, *openneſs*, *ſimplicity*, *gracefulneſs*; and there are others, which to our ſenſe of decorum appear *uncomely*, *affected*, *diſingenuous*, and *aukward*, quite unſuitable to the native dignity of our face and form. The *firſt* are in themſelves the moſt eaſy, natural, and commodious, give one boldneſs and preſence of mind, a modeſt aſſurance, an addreſs both awful and alluring; they beſpeak candour and greatneſs of mind, raiſe the moſt agreeable prejudices in one's favour, render ſociety engaging, command reſpect, and often love, and give weight and authority both in converſation and buſineſs; in fine, they are the colouring of virtue, which ſhow it to the greateſt advantage in whomſoever it is; and not only imitate, but in ſome meaſure ſupply it where it is wanting. Whereas the laſt, *viz. rudeneſs*, *affectation*, *indecorum*, and the like, have all the contrary effects; they are burdenſome to one's ſelf, a diſhonour to our nature, and a nuiſance in ſociety.

106 How attained.

The former qualities or goods are beſt attained by a liberal education, by preſerving a juſt ſenſe of the dignity of our nature, by keeping the beſt and politeſt company, but, above all, by acquiring thoſe virtuous and ennobling habits of mind which are decency in perfection, which will give an air of unaffected grandeur, and ſpread a luſtre truly engaging over the whole form and deportment.

107 Goods of exterior ſocial connections.

We are next to conſider thoſe goods which conſiſt in exterior ſocial connections, as *fame*, *fortune*, *civil authority*, *power*.

The firſt has a two-fold aſpect, as a good pleaſant in itſelf, or gratifying to an original paſſion, and then as expedient or uſeful towards a farther end.

108 Fame.

Honour from the wiſe and good, on the account of a virtuous conduct, is regaling to a good man; for then his heart re-echoes to the grateful ſound. There are few quite indifferent even to the commendation of the vulgar. Though we cannot approve that conduct which proceeds entirely from this principle, and not from good affection or love of the conduct itſelf, yet, as it is often a guard and additional motive to virtue in creatures imperfect as we are, and often diſtracted by interfering paſſions, it might be dangerous to ſuppreſs it altogether, however wiſe it may be to reſtrain it within due bounds, and however laudable to uſe it only as a ſcaffolding to our virtue, which may be taken down when that glorious ſtructure is finiſhed, but hardly till then.

then. To purſue fame for itſelf, is innocent; to regard it only as an auxiliary to virtue, is noble; to ſeek it chiefly as an engine of public uſefulneſs, is ſtill more noble, and highly praiſe-worthy. For though the opinion and breath of men are tranſient and fading things, often obtained without merit, and loſt without cauſe; yet as our buſineſs is with men, and as our capacity of ſerving them is generally increaſed in proportion to their eſteem of us, therefore ſound and well-eſtabliſhed *moral* applauſe may and will be modeſtly, not oſtentatiouſly, ſought after by the *good*; not indeed as a ſolitary refined ſort of luxury, but as a public and proper inſtrument to ſerve and bleſs mankind. At the ſame time they will learn to deſpiſe that reputation which is founded on rank, fortune, and any other circumſtances or accompliſhments that are foreign to real merit, or to uſeful ſervices done to others, and think that praiſe of little avail which is purchaſed without deſert, and beſtowed without judgment.

109 Fortune, power, &c.

Fortune, power, and *civil authority*, or whatever is called influence and weight among mankind, are *goods* of the *ſecond* diviſion, that is, valuable and purſuable only as they are *uſeful*, or as means to a farther end, *viz.* procuring or preſerving the immediate objects of enjoyment or happineſs to ourſelves or others. Therefore to love ſuch goods on their own account, and to purſue them as ends, not the means of enjoyment, muſt be highly prepoſterous and abſurd. There can be no meaſure, no limit, to ſuch purſuit; all muſt be whim, caprice, extravagance. Accordingly ſuch appetites, unlike all the *natural* ones, are increaſed by poſſeſſion, and whetted by enjoyment. They are always precarious, and never without fears, becauſe the objects lie without one's ſelf; they are ſeldom without ſorrow and vexation, becauſe no acceſſion of wealth or
110 How far purſuable.
power can ſatisfy them. But if thoſe goods are conſidered only as the materials or means of private or public happineſs, then the ſame obligations which bind us to purſue the latter, bind us likewiſe to purſue the former. We may, and no doubt we ought, to ſeek ſuch a meaſure of wealth as is neceſſary to ſupply all our real wants, to raiſe us above ſervile dependence, and provide us with ſuch conveniences as are ſuited to our rank and condition in life. To be regardleſs of this meaſure of wealth, is to expoſe ourſelves to all the temptations of poverty and corruption; to forfeit our natural independency and freedom; to degrade, and conſequently to render the rank we hold, and the character we ſuſtain in ſociety, uſeleſs, if not contemptible. When theſe important ends are ſecured, we ought not to murmur or repine that we poſſeſs no more; yet we are not ſecluded by any obligation, moral or divine, from ſeeking more, in order to give us that happieſt and moſt god-like of all powers, the *power* of *doing good*. A ſupine indolence in this reſpect is both abſurd and criminal; *abſurd*, as it robs us of an inexhauſted fund of the moſt refined and
111 Avarice.
durable enjoyments; and *criminal*, as it renders us ſo far uſeleſs to the ſociety to which we belong. "That purſuit of wealth which goes beyond the former end, *viz.* the obtaining the neceſſaries, or ſuch conveniencies of life, as, in the eſtimation of reaſon, not of vanity or paſſion, are ſuited to our rank and condition, and yet is not directed to the latter, viz. the doing good, is what we call *avarice*." And "that purſuit of *power*, which, after ſecuring one's ſelf, *i. e.* having attained the proper independence and liberty of a rational ſocial creature, is not directed to the good of others, is what we call *ambition*, or the *luſt of power*."

112 Ambition.

To what extent the ſtrict meaſures of virtue will allow us to purſue either wealth or power, and civil authority, is not perhaps poſſible preciſely to determine. That muſt be left to prudence, and the peculiar character, condition, and other circumſtances of each man. Only thus far a limit may be ſet, that the purſuit of either muſt encroach upon no other duty or obligation which we owe to ourſelves, to ſociety, or to its parent and head. The ſame reaſoning is to be applied to *power* as to *wealth*. It is only valuable as an inſtrument of our own ſecurity, and of the free enjoyment of thoſe original goods it may, and often does, adminiſter to us, and as an engine of more extenſive happineſs to our friends, our country, and mankind.

113 How fame and power are attained.

Now the beſt, and indeed the only way to obtain a ſolid and laſting fame, is an uniform inflexible courſe of virtue, the employing one's ability and wealth in ſupplying the wants, and uſing one's power in promoting or ſecuring the happineſs, the rights and liberties of mankind, joined to an univerſal affability and politeneſs of manners. And ſurely one will not miſtake the matter much, who thinks the ſame courſe conducive to the acquiring greater acceſſions both of wealth and power; eſpecially if he adds to thoſe qualifications a vigorous induſtry, a conſtant attention to the characters and wants of men, to the conjunctures of times, and continually-varying genius of affairs; and a ſteady intrepid honeſty, that will neither yield to the allurements, nor be over-awed with the terrors, of that corrupt and corrupting ſcene in which we live. We have ſometimes heard indeed of other ways and means, as fraud, diſſimulation, ſervility, and proſtitution, and the like ignoble arts, by which the men of the world (as they are called, ſhrewd politicians, and men of addreſs!) amaſs wealth, and procure power; but as we want rather to form a man of virtue, an honeſt, contented, happy man, we leave to the men of the world their own ways, and permit them, unenvied and unimitated by us, to reap the fruit of their doings.

114 Goods of the intellect.

The next ſpecies of objects in the ſcale of good, are the goods of the *intellect*, as *knowledge, memory, judgement, taſte, ſagacity, docility*, and whatever elſe we call intellectual virtues. Let us conſider them a little, and the means as well as obligations to improve them.

115 Their moment.

As *man* is a *rational* creature, capable of knowing the differences of things and actions;—as he not only ſees and feels what is preſent, but remembers what is paſt, and often foreſees what is future;—as he advances from ſmall beginnings by ſlow degrees, and with much labour and difficulty, to knowledge and experience;—as his opinions ſway his paſſions,—as his paſſions influence his conduct,—and as his conduct draws conſequences after it, which extend not only to the preſent but to the future time, and therefore is the principal ſource of his happineſs or miſery; it is evident, that he is formed for intellectual improvements, and that it muſt be of the utmoſt conſequence for him to improve and cultivate his intellectual powers, on which thoſe opinions, thoſe paſſions, and that conduct depend *.

But beſides the future conſequences and moment of improving

* *Philoſ. Sinic. Confuc.* lib. 1. § 3, 4, &c.

Of Man's duty to Himself.

improving our intellectual powers, their immediate exercise on their proper objects yields the most rational and refined pleasures. Knowledge, and a right taste in
116 The pleasures they give. the arts of *imitation* and *design*, as *poetry*, *painting*, *sculpture*, *music*, *architecture*, afford not only an innocent, but a most sensible and sublime entertainment. By
117 Knowledge and taste; these the understanding is instructed in ancient and modern life, the history of men and things, the energies and effects of the passions, the consequences of virtue and vice; by these the imagination is at once entertained and nourished with the beauties of nature and art, lighted up and spread out with the novelty, grandeur, and harmony of the universe; and, in fine, the passions are agreeably roused, and suitably engaged, by the greatest and most interesting objects that can fill the human mind. He who has a taste formed to these ingenious delights, and plenty of materials to gratify it, can never want the most agreeable exercise and entertainment, nor once have reason to make that fashionable complaint of the tediousness of time. Nor can he want a proper subject for the discipline and improvement of his heart. For, being daily conversant with *beauty*, *order*, and *design*, in inferior subjects, he bids fair for growing in due time an admirer of what is fair and well-proportioned in the conduct of life and the order of society, which is only order and design exerted in their highest subject. He will learn to transfer the numbers of poetry to the harmony of the mind and of well-governed passions; and, from admiring the virtues of others in moral paintings, come to approve and imitate them himself. Therefore, to cultivate a *true* and *correct taste* must be both our interest and our duty, when the circumstances of our station give leisure and opportunity for it, and when the doing it is not inconsistent with our higher obligations or engagements to society and mankind.

118 How attained. It is best attained by reading the best books, where *good sense* has more the ascendant than *learning*, and which pertain more to *practice* than to *speculation*; by studying the best models, *i. e.* those which profess to imitate nature most, and approach the nearest to it, and by conversing with men of the most refined taste, and the greatest experience in life.

119 Other intellectual goods; As to the other intellectual goods, what a fund of entertainment must it be to investigate the truth and various relations of things, to trace the operations of nature to general laws, to explain by these its manifold phenomena, to understand that order by which the universe is upheld, and that œconomy by which it is governed! to be acquainted with the human mind, the connections, subordinations, and uses of its powers, and to mark their energy in life! how agreeable to the ingenious inquirer, to observe the manifold relations and combinations of individual minds in society, to discern the causes why they flourish or decay, and from thence to ascend, through the vast scale of beings, to that general mind which presides over all, and operates unseen in every system and in every age, through the whole compass and progression of nature! Devoted to such entertainments as these, the contemplative have abandoned every other pleasure, retired from the body, so to speak, and sequestered themselves from social intercourse; for these, the *busy* have often preferred to the hurry and din of life the calm retreats of contemplation; for these, when once they came to taste them, even the *gay* and *voluptuous* have thrown up the lawless pursuits of sense and appetite, and acknowledged these mentual enjoyments to be the most *refined*, and indeed the *only* luxury. Besides, by a just and large knowledge of nature, we recognise the perfections of its author; and thus piety, and all those pious affections which depend on just sentiments of his character, are awakened and confirmed; and a thousand superstitious fears, that arise from partial views of his nature and works, will of course be excluded. An extensive prospect of human life, and of the periods and revolutions of human things, will conduce much to the giving a certain greatness of mind, and a noble contempt to those little competitions about power, honour, and wealth, which disturb and divide the bulk of mankind; and promote a calm endurance of those inconveniences and ills that are the common appendages of humanity. Add to all, that a just knowledge of human nature, and of those hinges upon which the business and fortunes of men turn, will prevent our thinking either too highly or too meanly of our fellow-creatures, give no small scope to the exercise of friendship, confidence, and good-will, and at the same time brace the mind with a proper caution and distrust (those nerves of prudence), and give a greater mastery in the conduct of private as well as public life. Therefore, by cultivating our intellectual abilities, we shall best promote and secure our interest, and be qualified for acting our part in society with more honour to ourselves, as well as advantage to mankind. Consequently, to improve them to the utmost of our power is our duty; they are talents committed to us by the Almighty Head of society, and we are accountable to him for the use of them. 120

The intellectual virtues are best improved by accurate and impartial observation, extensive reading, and unconfined converse with men of all characters, especially with those who, to private study, have joined the widest acquaintance with the world, and greatest practice in affairs; but, above all, by being much in the world, and having large dealings with mankind. Such opportunities contribute much to divest one of prejudices and a servile attachment to crude systems, to open one's views, and to give that experience on which the most useful because the most practical knowledge is built, and from which the surest maxims for the conduct of life are deduced. 121 How attained.

The highest goods which enter into the composition of human happiness are *moral* goods of the mind, directly and ultimately regarding ourselves; as *command of the appetites and passions*, *prudence and caution*, *magnanimity*, *fortitude*, *humility*, *love of virtue*, *love of God*, *resignation*, and the like. These sublime goods are goods by way of eminence, goods recommended and enforced by the most intimate and awful sense and consciousness of our nature; goods that constitute the quintessence, the very temper of happiness, that form and complexion of soul which renders us approveable and lovely in the sight of God; goods, in fine, which are the elements of all our future perfection and felicity. 122 Moral goods.

Most of the other goods we have considered depend partly on ourselves, and partly on accidents which we can neither foresee nor prevent, and result from causes which we cannot influence or alter. They are such goods as we may possess to-day and lose to-morrow, Their moment.

and

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and which require a felicity of conſtitution, and talents to attain them in full vigour and perfection, and a felicity of conjunctures to ſecure the poſſeſſion of them. Therefore, did our happineſs depend altogether or chiefly on ſuch tranſitory and precarious poſſeſſions, it were itſelf moſt precarious, and the higheſt folly to be anxious about it. — — But though creatures, conſtituted as we are, cannot be indifferent about ſuch goods, and muſt ſuffer in ſome degree, and conſequently have our happineſs incomplete without them, yet they weigh but little in the ſcale when compared with moral goods. By the benevolent conſtitution of our nature, theſe are placed within the ſphere of our activity, ſo that no man can be deſtitute of them unleſs he is firſt wanting to himſelf. Some of the wiſeſt and beſt of mankind have wanted moſt of the former goods, and all the external kind, and felt moſt of the oppoſite ills, ſuch at leaſt as ariſe from without; yet by poſſeſſing the latter, *viz.* the moral goods, have declared they were happy; and to the conviction of the moſt impartial obſervers have appeared happy. The worſt of men have been ſurrounded with every outward good and advantage of fortune, and have poſſeſſed great parts; yet, for want of moral rectitude, have been, and have confeſſed themſelves, notoriouſly and exquiſitely miſerable. The exerciſe of virtue has ſupported its votaries, and made them exult in the midſt of tortures almoſt intolerable; nay, how often has ſome falſe form or ſhadow of it ſuſtained even the greateſt (D) villains and bigots under the ſame preſſures! But no external goods, no goods of fortune, have been able to alleviate the agonies or expel the fears of a guilty mind, conſcious of the deſerved hatred and reproach of mankind, and the juſt diſpleaſure of Almighty God.

123 The mixed condition of human life requires particular virtues.

As the preſent condition of human life is wonderfully chequered with good and ill, and as no height of ſtation, no affluence of fortune, can abſolutely inſure the good, or ſecure againſt the ill, it is evident that a great part of the comfort and ſerenity of life muſt lie in having our minds duly affected with regard to both, *i. e.* rightly attempered to the loſs of one and the ſufferance of the other. For it is certain that outward calamities derive their chief malignity and preſſure from the inward diſpoſitions with which we receive them. By managing theſe right, we may greatly abate that malignity and preſſure, and conſequently diminiſh the number, and weaken the moment, of the ills of life, if we ſhould not have it in our power to obtain a large ſhare of its goods. There are particularly three virtues which go to the forming this right temper towards ill, and which are of ſingular efficacy, if not totally to remove, yet wonderfully to alleviate, the calamities of life. Theſe are *fortitude* or *patience*, *humility* and *reſignation*.

124 Fortitude.

Fortitude is that calm and ſteady habit of mind which either moderates our fears, and enables us bravely to encounter the proſpect of ill, or renders the mind ſerene and invincible under its immediate preſſure. It lies equally diſtant from raſhneſs and cowardice; and though it does not hinder us from feeling, yet prevents our complaining or ſhrinking under the ſtroke. It always includes a generous contempt of, or at leaſt a noble ſuperiority to, thoſe precarious goods of which we can inſure neither the poſſeſſion nor continuance. The man therefore who poſſeſſes this virtue in this ample ſenſe of it, ſtands upon an eminence, and ſees human things below him; the tempeſt indeed may reach him, but he ſtands ſecure and collected againſt it upon the baſis of conſcious virtue, which the ſevereſt ſtorms can ſeldom ſhake, and never overthrow.

125 Humility.

Humility is another virtue of high rank and dignity, though often miſtaken by proud mortals for meanneſs and puſillanimity. It is oppoſed to *pride*, which commonly includes in it a falſe or over-rated eſtimation of our own merit, an aſcription of it to ourſelves as its only and original cauſe, an undue compariſon of ourſelves with others, and in conſequence of that ſuppoſed ſuperiority, an arrogant preference of ourſelves, and a ſupercilious contempt of them. *Humility*, on the other hand, ſeems to denote that modeſt and ingenuous temper of mind, which ariſes from a juſt and equal eſtimate of our own advantages compared with thoſe of others, and from a ſenſe of our deriving all originally from the Author of our being. Its ordinary attendants are mildneſs, a gentle forbearance, and an eaſy unaſſuming humanity with regard to the imperfections and faults of others; virtues rare indeed, but of the faireſt complexion, the proper offspring of ſo lovely a parent, the beſt ornaments of ſuch imperfect creatures as we are, precious in the ſight of God, and which ſweetly allure the hearts of men.

126 Reſignation.

Reſignation is that mild and heroic temper of mind which ariſes from a ſenſe of an infinitely wiſe and good providence, and enables one to acquieſce with a cordial affection in its juſt appointments. This virtue has ſomething very particular in its nature, and ſublime in its efficacy. For it teaches us to bear ill, not only with patience, and as being unavoidable, but it transforms, as it were, ill into good, by leading us to conſider it, and every event that has the leaſt appearance of ill, as a divine diſpenſation, a wiſe and benevolent temperament of things, ſubſervient to univerſal good, and of courſe including that of every individual, eſpecially of ſuch as calmly ſtoop to it. In this light, the adminiſtration itſelf, nay every act of it, becomes an object of affection, the evil diſappears, or is converted into a balm which both heals and nouriſheth the mind. For though the firſt unexpected acceſs of ill may ſurpriſe the ſoul into grief, yet that grief, when the mind calmly reviews its object, changes into contentment, and is by degrees exalted into veneration and a divine compoſure. Our private will is loſt in that of the Almighty, and our ſecurity againſt every real ill reſts on the ſame bottom as the throne of him who lives and reigns for ever.

127 Chief good, *objective* and *formal*.

Before we finiſh this ſection, it may be fit to obſerve, that as the Deity is the ſupreme and inexhauſted ſource of good, on whom the happineſs of the whole creation

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(D) As Ravilliac, who aſſaſſinated Henry IV. of France; and Balthaſar Geraerd, who murdered William I. prince of Orange.

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creation depends; as he is the higheſt object in nature, and the only object who is fully proportioned to the intellectual and moral powers of the mind, in whom they ultimately reſt, and find their moſt perfect exerciſe and completion; he is therefore termed the *Chief good of man*, objectively conſidered. And *virtue*, or the proportioned and vigorous exerciſe of the ſeveral powers and affections on their reſpective objects, as above deſcribed, is, in the ſchools, termed the *chief good*, formally conſidered, or its formal idea, being the inward temper and native conſtitution of human happineſs.

From the detail we have gone through, the following corollaries may be deduced.

128 Corollaries. *Firſt*, It is evident, that the happineſs of ſuch a *progreſſive* creature as man can never be at a ſtand, or continue a fixed invariable thing. His finite nature, let it riſe ever ſo high, admits ſtill higher degrees of improvement and perfection. And his progreſſion in improvement or virtue always makes way for a progreſſion in happineſs. So that no poſſible point can be aſſigned in any period of his exiſtence in which he is perfectly happy, that is, ſo happy as to exclude higher degrees of happineſs. All his perfection is only comparative. 2. It appears that many things muſt conſpire to complete the happineſs of ſo *various* a creature as man, ſubject to ſo many wants, and ſuſceptible of ſuch different pleaſures. 3. As his capacities of pleaſure cannot be all gratified at the ſame time, and muſt often interfere with each other in ſuch a precarious and fleeting ſtate as human life, or be frequently diſappointed, perfect happineſs, *i. e.* the undiſturbed enjoyment of the ſeveral pleaſures of which we are capable, is unattainable in our preſent ſtate. 4. That ſtate is moſt to be ſought after, in which the feweſt competitions and diſappointments can happen, which leaſt of all impairs any ſenſe of pleaſure, and opens an inexhauſted ſource of the moſt refined and laſting enjoyments. 5. That ſtate which is attended with all thoſe advantages, is a ſtate or courſe of virtue. 6. *Therefore*, a ſtate of *virtue*, in which the moral goods of the mind are attained, is the *happieſt ſtate*.

Chap. III. *Duties of* Society.

Sect. I. *Filial and Fraternal Duty.*

As we have followed the order of nature in tracing the hiſtory of man, and thoſe duties which he owes to himſelf, it ſeems reaſonable to take the ſame method with thoſe he owes to ſociety, which conſtitute the *ſecond* claſs of his *obligations*.

129 Connection of parents. His parents are among the earlieſt objects of his attention; he becomes ſooneſt acquainted with them, repoſes a peculiar confidence in them, and ſeems to regard them with a fond affection, the early prognoſtics of his future *piety* and *gratitude*. Thus does nature dictate the firſt lines of filial duty, even before a juſt ſenſe of the connection is formed. But when the child is grown up, and has attained to ſuch a degree of underſtanding, as to comprehend the *moral tie*, and be ſenſible of the obligations he is under to his parents; when he looks back on their tender and diſintereſted affection, their inceſſant cares and labours in nurſing, educating, and providing for him, during that ſtate in which he had neither prudence nor ſtrength to care and provide for himſelf, he muſt be conſcious that he owes to them theſe peculiar duties.

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130 Duties to parents.

1. To reverence and honour them, as the inſtruments of nature in introducing him to life, and to that ſtate of comfort and happineſs which he enjoys; and therefore to eſteem and imitate their good qualities, to alleviate and bear with, and ſpread, as much as poſſible, a decent veil over their faults and weakneſſes.

2. To be highly grateful to them, for thoſe favours which it can hardly ever be in his power fully to repay; to ſhow this gratitude by a ſtrict attention to their wants, and a ſolicitous care to ſupply them; by a ſubmiſſive deference to their authority and advice, eſpecially by paying great regard to it in the choice of a wife, and of an occupation; by yielding to, rather than peeviſhly contending with, their humours, as remembering how oft they have been perſecuted by his; and, in fine, by ſoothing their cares, lightening their ſorrows, ſupporting the infirmities of age, and making the remainder of their life as comfortable and joyful as poſſible.

131 Duties to brethren and ſiſters. As his brethren and ſiſters are the next with whom the creature forms a *ſocial* and *moral* connection, to them he owes a *fraternal* regard; and with them ought he to enter into a ſtrict league of friendſhip, mutual ſympathy, advice, aſſiſtance, and a generous intercourſe of kind offices, remembering their relation to common parents, and that brotherhood of nature which unites them into a cloſer community of intereſt and affection.

Sect. II. *Concerning Marriage.*

132 Connection with the other ſex. When man arrives to a certain age, he becomes ſenſible of a peculiar ſympathy and tenderneſs towards the other ſex; the charms of beauty engage his attention, and call forth new and ſofter diſpoſitions than he has yet felt. The many amiable qualities exhibited by a fair outſide, or by the mild allurement of female manners, or which the prejudiced ſpectator without much reaſoning ſuppoſes thoſe to include, with ſeveral other circumſtances both natural and accidental, point his view and affection to a particular object, and of courſe contract that general rambling regard, which was loſt and uſeleſs among the undiſtinguiſhed crowd, into a peculiar and permanent attachment to one woman, which ordinarily terminates in the moſt important, venerable, and delightful connection in life.

133 The grounds of this connection. The ſtate of the brute creation is very different from that of human creatures. The former are clothed and generally armed by their ſtructure, eaſily find what is neceſſary to their ſubſiſtence, and ſoon attain their vigour and maturity; ſo that they need the care and aid of their parents but for a ſhort while; and therefore we ſee that nature has aſſigned to them vagrant and tranſient amours. The connection being purely *natural*, and merely for propagating and rearing their offspring, no ſooner is that end anſwered, than the connection diſſolves of courſe. But the human race are of a more tender and defenceleſs conſtitution; their infancy and non-age continue longer; they advance ſlowly to ſtrength of body and maturity of reaſon; they need conſtant attention, and a long ſeries of cares and labours, to train them up to decency, virtue, and the various arts of life. Nature has, there-

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therefore, provided them with the moft affectionate and anxious tutors, to aid their weaknefs, to fupply their wants, and to accomplifh them in thofe neceffary arts, even their own parents, on whom fhe has devolved this mighty charge, rendered agreeable by the moft alluring and powerful of all ties, parental affection. But unlefs both concur in this grateful tafk, and continue their joint labours, till they have reared up and planted out their young colony, it muft become a prey to every rude invader, and the purpofe of nature in the original union of the human pair be defeated. Therefore our ftructure as well as condition is an evident indication, that the human fexes are deftined for a more intimate, for a moral and lafting union. It appears likewife, that the principal end of marriage is not to propagate and nurfe up an offspring, but to educate and form minds for the great duties and extenfive deftinations of life. Society muft be fupplied from this original nurfery with ufeful members, and its faireft ornaments and fupports.

134 Moral ends of marriage.

The mind is apt to be diffipated in its views and acts of friendfhip and humanity; unlefs the *former* be directed to a particular object, and the *latter* employed in a particular province. When men once indulge in this diffipation, there is no ftopping their career; they grow infenfible to moral attractions; and, by obftructing or impairing the decent and regular exercife of the tender and generous feelings of the human heart, they in time become unqualified for, or averfe to, the forming a moral union of fouls, which is the cement of fociety, and the fource of the pureft domeftic joys. Whereas a rational, undepraved *love*, and its fair companion, *marriage*, collect a man's views, guide his heart to its proper object, and, by confining his affection to that object, do really enlarge its influence and ufe. Befides, it is but too evident from the conduct of mankind, that the common ties of humanity are too feeble to engage and intereft the paffions of the generality in the affairs of fociety. The connections of neighbourhood, acquaintance, and general intercourfe, are too wide a field of action for many, and thofe of a *public* or *community* are fo for more; and in which they *either care not*, *or know not how* to exert themfelves. Therefore nature, ever wife and benevolent, by implanting that ftrong fympathy which reigns between the individuals of each fex, and by urging them to form a particular moral connection, the fpring of many domeftic endearments has meafured out to each pair a particular *fphere of action*, proportioned to their views, and adapted to their refpective capacities. Befides, by interefting them deeply in the concerns of their own little circle, fhe has connected them more clofely with fociety, which is compofed of particular families, and bound them down to their good behaviour in that particular community to which they belong. This *moral connection* is *marriage*, and this *fphere of action* is a *family*.

135 Duties of marriage.

Of the *conjugal* alliance the following are the *natural laws*. Firft, mutual fidelity to the marriage-bed. Difloyalty defeats the very end of marriage; diffolves the natural cement of the relation; weakens the moral tie, the chief ftrength of which lies in the reciprocation of affection; and, by making the offspring uncertain, diminifhes the care and attachment neceffary to their education.

2. A confpiration of counfels and endeavours to promote the common intereft of the family, and to educate their common offspring. In order to obferve thefe laws, it is neceffary to cultivate, both before and during the married ftate, the ftricteft decency and chaftity of manners, and a juft fenfe of what becomes their refpective characters.

3. The union muft be inviolable, and for life. The nature of friendfhip, and particularly of this fpecies of it, the education of their offspring, and the order of fociety and of fucceffions, which would otherwife be extremely perplexed, do all feem to require it. To preferve this union, and render the matrimonial ftate more harmonious and comfortable, a mutual efteem and tendernefs, a mutual deference and forbearance, a communication of advice, and affiftance and authority, are abfolutely neceffary. If either party keep within their proper departments, there need be no difputes about power or fuperiority, and there will be none. They have no *oppofite*, no *feparate* interefts, and therefore there can be no juft ground for oppofition of conduct.

From this detail, and the prefent ftate of things, in which there is pretty near a parity of numbers of both fexes, it is evident that *polygamy* is an *unnatural* ftate; and though it fhould be granted to be more fruitful of children, which however it is not found to be, yet it is by no means fo fit for rearing minds, which feems to be as much, if not more, the intention of nature than the propagation of bodies. 136 Polygamy.

Sect. III. *Of Parental Duty.*

The connection of parents with their children is a natural confequence of the matrimonial connection; and the duties which they owe them refult as naturally from that connection. The feeble ftate of children, fubject to fo many wants and dangers, requires their inceffant care and attention; their ignorant and uncultivated minds demand their continual inftruction and culture. Had human creatures come into the world with the full ftrength of *men*, and the weaknefs of reafon and vehemence of paffions which prevail in *children*, they would have been too ftrong or too ftubborn to have fubmitted to the government and inftruction of their parents. But as they were defigned for a progreffion in knowledge and virtue, it was proper that the growth of their bodies fhould keep pace with that of their minds, left the purpofes of that progreffion fhould have been defeated. Among other admirable purpofes which this gradual expanfion of their outward as well as inward ftructure ferves, this is one, that it affords ample fcope to the exercife of many tender and generous affections, which fill up the domeftic life with a beautiful variety of duties and enjoyments; and are of courfe a noble difcipline for the heart, and an hardy kind of education for the more honourable and important duties of *public* life. 137 Connection of parents and children.

The above mentioned weak and ignorant ftate of children feems plainly to inveft their parents with fuch authority and power as is neceffary to their fupport, protection, and education; but that authority and power can be conftrued to extend no farther than is neceffary to anfwer thofe ends, and to laft no longer than that weaknefs and ignorance continue; wherefore, the foundation or reafon of the authority and power 138 The authority founded on that connection.

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power ceasing, they cease of course. Whatever power or authority then it may be necessary or lawful for parents to exercise during the non-age of their children, to assume or usurp the same when they have attained the maturity or full exercise of their strength and reason would be tyrannical and unjust. From hence it is evident, that parents have no right to punish the persons of their children more severely than the nature of their wardship requires, much less to invade their lives, to encroach upon their liberty, or transfer them as their property to any master whatsoever.

139 Duties of parents.

The first class of duties which parents owe their children respect their natural life; and these comprehend protection, nurture, provision, introducing them into the world in a manner suitable to their rank and fortune, and the like.

140 Education.

The second order of duties regards the *intellectual* and *moral* life of their children, or their education in such arts and accomplishments as are necessary to qualify them for performing the duties they owe to themselves and to others. As this was found to be the principal design of the matrimonial alliance, so the fulfilling that design is the most important and dignified of all the parental duties. In order therefore to fit the child for acting his part wisely and worthily as a *man*, as a *citizen*, and a *creature of God*, both parents ought to combine their joint wisdom, authority, and power, and each apart to employ those talents which are the peculiar excellency and ornament of their respective sex. The father ought to *lay out* and *superintend* their education, the mother to execute and manage the detail of which she is capable. The *former* should direct the manly exertion of the intellectual and moral powers of his child. His imagination, and the manner of those exertions, are the peculiar province of the *latter*. The *former* should advise, protect, command, and, by his experience, masculine vigour, and that superior authority which is commonly ascribed to his sex, brace and strengthen his pupil for *active* life, for gravity, integrity, and firmness in suffering. The business of the *latter* is to bend and soften her *male* pupil, by the charms of her conversation, and the softness and decency of her manners, for *social* life, for politeness of taste, and the elegant decorums and enjoyments of humanity; and to improve and refine the tenderness and modesty of her *female* pupil, and form her to all those mild domestic virtues which are the peculiar characteristics and ornaments of her sex. To conduct the opening minds of their sweet charge through the several periods of their progress, to assist them in each period, in throwing out the latent seeds of reason and ingenuity, and in gaining fresh accessions of light and virtue; and at length, with all these advantages, to produce the young adventurers upon the great theatre of human life, to play their several parts in the sight of their friends, of society, and mankind!

Sect. IV. *Herile and Servile Duty.*

141 The ground of this connection.

In the natural course of human affairs, it must necessarily happen that some of mankind will live in plenty and opulence, and others be reduced to a state of indigence and poverty. The former need the labours of the latter and the latter provision and support of the former. This mutual necessity is the foundation of that connection, whether we call it *moral* or *civil*, which subsists between masters and servants.

142 The conditions of service.

He who feeds another has a right to some equivalent, the labour of him whom he maintains, and the fruits of it. And he who labours for another has a right to expect that he should support him. But as the labours of a man of ordinary strength are certainly of greater value than mere food and cloathing; because they would actually produce more, even the maintenance of a family, were the labourer to employ them in his own behalf; therefore he has an undoubted right to rate and dispose of his service for certain wages above mere maintenance; and if he has incautiously disposed of it for the latter only, yet the contract being of the *onerous* kind, he may equitably claim a supply of that deficiency. If the service be specified, the servant is bound to that only; if not, then he is to be construed as bound only to such services as are consistent with the laws of justice and humanity. By the voluntary servitude to which he subjects himself, he forfeits no rights but such as are necessarily included in that servitude, and is obnoxious to no punishment but such as a voluntary failure in the service may be supposed reasonably to require. *The offspring of such servants* have a right to that liberty which neither they nor their parents have forfeited.

143 The case of great offenders.

As to those who, because of some heinous offence, or for some notorious damage, for which they cannot otherwise compensate, are condemned to perpetual service, they do not, on that account, forfeit all the rights of men; but those, the loss of which is necessary to secure society against the like offences for the future, or to repair the damage they have done.

144 The case of captives.

With regard to captives taken in war, it is barbarous and inhuman to make perpetual slaves of them, unless some peculiar and aggravated circumstances of guilt have attended their hostility. The bulk of the subjects of any government engaged in war may be fairly esteemed innocent enemies; and therefore they have a right to that clemency which is consistent with the common safety of mankind, and the particular security of that society against which they are engaged. Though ordinary captives have a grant of their lives, yet to pay their liberty as an equivalent is much too high a price. There are other ways of acknowledging or returning the favour, than by surrendering what is far dearer than life itself *. To those who, under pretext of the necessities of commerce, drive the unnatural trade of bargaining for human flesh, and consigning their innocent but unfortunate fellow creatures to eternal servitude and misery, we may address the words of a fine writer; "Let avarice defend it as it will, there is an honest reluctance in humanity against buying and selling, and regarding those of our own species as our wealth and possessions."

* *Hutchef. Mor. Inst. Phil.* lib. 3. 3.

Sect. V. *Social Duties of the private Kind.*

Hitherto we have considered only the *domestic œconomical* duties, because these are first in the progress of nature. But as man passes beyond the little circle of a family, he forms connections with relations, friends, neighbours, and others; from whence results

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a new train of duties of the more private ſocial kind, as "friendſhip, chaſtity, courteſy, good-neighbourhood, charity, forgiveneſs, hoſpitality."

145 Man's aptitude for ſociety.

Man is admirably formed for particular ſocial attachments and duties. There is a peculiar and ſtrong propenſity in his nature to be affected with the ſentiments and diſpoſitions of others. Men, like certain muſical inſtruments, are ſet to each other, ſo that the vibrations or notes excited in one raiſe correſpondent notes and vibrations in the others. The impulſes of *pleaſure* or *pain*, *joy* or *ſorrow*, made on one mind, are by an inſtantaneous ſympathy of nature communicated in ſome degree to all; eſpecially when hearts are (as an humane writer expreſſes it) in *uniſon* of kindneſs; the joy that vibrates in one communicates to the other alſo. We may add, that though joy thus imparted ſwells the harmony, yet grief vibrated to the heart of a friend, and rebounding from thence in ſympathetic notes, melts as it were, and almoſt dies away. All the paſſions, but eſpecially thoſe of the ſocial kind, are contagious; and when the paſſions of one man mingle with thoſe of another, they increaſe and multiply prodigiouſly. There is a moſt moving eloquence in the human countenance, air, voice, and geſture, wonderfully expreſſive of the moſt latent feelings and paſſions of the ſoul, which darts them like a ſubtle flame into the hearts of others, and raiſes correſpondent feelings there: friendſhip, love, good-humour, joy, ſpread through every feature, and particularly ſhoot from the eyes their ſofter and fiercer fires with an irreſiſtible energy. And in like manner the oppoſite paſſions of hatred, enmity, ill-humour, melancholy, diffuſe a ſullen and ſaddening air over the face, and, flaſhing from eye to eye, kindle a train of ſimilar paſſions. By theſe, and other admirable pieces of machinery, men are formed for ſociety and the delightful interchange of friendly ſentiments and duties, to increaſe the happineſs of others by participation, and their own by rebound; and to diminiſh, by dividing, the common ſtock of their miſery.

146 Duties ariſing from private relation.

The firſt emanations of the *ſocial* principle beyond the bounds of a family lead us to form a nearer conjunction of friendſhip or good-will with thoſe who are any wiſe connected with us by *blood* or *domeſtic alliance*. To them our affection does commonly exert itſelf in a greater or leſs degree, according to the nearneſs or diſtance of the relation. And this proportion is admirably ſuited to the extent of our powers and the indigence of our ſtate; for it is only within thoſe leſſer circles of conſanguinity or alliance that the generality of mankind are able to diſplay their abilities or benevolence, and conſequently to uphold their connection with ſociety and ſubſerviency, to a public intereſt. Therefore it is our duty to regard theſe cloſer connections as the next department to that of a family, in which nature has marked out for us a ſphere of activity and uſefulneſs; and to cultivate the kind affections which are the cement of thoſe endearing alliances.

147 Ingredients of friendſhip.

Frequently the view of diſtinguiſhing moral qualities in ſome of our acquaintance may give birth to that more noble connection we call FRIENDSHIP, which is far ſuperior to the alliances of conſanguinity. For theſe are of a ſuperficial, and often of a tranſitory nature, of which, as they hold more of *inſtinct* than of *reaſon*, we cannot give ſuch a rational account. But *friendſhip* derives all its ſtrength and beauty, and the only exiſtence which is durable, from the qualities of the heart, or from virtuous and lovely diſpoſitions. Or, ſhould theſe be wanting, they or ſome ſhadow of them muſt be ſuppoſed preſent.—Therefore *friendſhip* may be deſcribed to be, "The union of two ſouls by means of *virtue*, the common object and cement of their mutual affection." Without virtue, or the ſuppoſition of it, friendſhip is only a *mercenary* league, an alliance of intereſt, which muſt diſſolve of courſe when that intereſt decays or ſubſiſts no longer. It is not ſo much any particular paſſion, as a compoſition of ſome of the nobleſt feelings and paſſions of the mind. *Good ſenſe*, a *juſt taſte* and *love of virtue*, a *thorough candour* and *benignity of heart*, or what we uſually call a *good temper*, and a generous ſympathy of ſentiments and affections, are the neceſſary ingredients of this virtuous connection. When it is grafted on eſteem ſtrengthened by habit, and mellowed by time, it yields infinite pleaſure, ever new and ever growing; is a noble ſupport amidſt the various trials and viciſſitudes of life, and an high ſeaſoning to moſt of our other enjoyments.—To form and cultivate virtuous friendſhip, muſt be very improving to the temper, as its principal *object* is *virtue*, ſet off with all the allurement of countenance, air, and manners, ſhining forth in the native graces of manly honeſt ſentiments and affections, and rendered *viſible* as it were to the friendly ſpectator in a conduct unaffectedly great and good; and as its principal exerciſes are the very energies of virtue, or its effect and emanations. So that wherever this amiable attachment prevails, it will exalt our admiration and attachment to virtue, and, unleſs impeded in its courſe by unnatural prejudices, run out into a friendſhip to the human race. For as no one can merit, and none ought to uſurp, the ſacred name of friend, who hates mankind; ſo whoever truly loves *them*, poſſeſſes the moſt eſſential quality of a true friend.

148 Its duties.

The duties of friendſhip are a mutual eſteem of each other, unbribed by intereſt, and independent of it, a generous confidence as far diſtant from ſuſpicion as from reſerve, an inviolable harmony of ſentiments and diſpoſitions of deſigns and intereſts, a fidelity unſhaken by the changes of fortune, a conſtancy unalterable by diſtance of time or place, a reſignation of one's perſonal intereſt to thoſe of one's friend, and a reciprocal, unenvious, unreſerved exchange of kind offices.—But, amidſt all the exertions of this moral connection, humane and generous as it is, we muſt remember that it operates within a narrow ſphere, and its immediate operations reſpect only the individual; and therefore its particular impulſes muſt ſtill be ſubordinate to a more public intereſt, or be always directed and controlled by the more extenſive connections of our nature.

149 Love and chaſtity.

When our friendſhip terminates on any of the other ſex, in whom beauty or agreeableneſs of perſon and external gracefulneſs of manners conſpire to expreſs and heighten the moral charm of a tender honeſt heart, and ſweet, ingenuous, modeſt temper, lighted up by good ſenſe; it generally grows into a more ſoft and endearing attachment. When this attachment is im-

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proved by a growing acquaintance with the worth of its object, is conducted by discretion, and issues at length, as it ought to do, in the moral connection formerly mentioned ‡, it becomes the source of many amiable duties, of a communication of passions and interests, of the most refined decencies, and of a thousand nameless deep-felt joys of reciprocal tenderness and love, flowing from every look, word, and action. Here friendship acts with double energy, and the *natural* conspires with the *moral* charms to strengthen and secure the love of virtue. As the delicate nature of female honour and decorum, and the inexpressible grace of a chaste and modest behaviour, are the surest and indeed the only means of kindling at first, and ever after of keeping alive, this tender and elegant flame, and of accomplishing the excellent ends designed by it; to attempt by fraud to violate one, or, under pretence of passion, to fully and corrupt the other, and, by so doing, to expose the too often credulous and unguarded object, with a wanton cruelty, to the hatred of her own sex and the scorn of ours, and to the lowest infamy of both, is a conduct not only base and criminal, but inconsistent with that truly rational and refined enjoyment, the spirit and quintessence of which is derived from the bashful and sacred charms of virtue kept untainted, and therefore ever alluring to the lover's heart.

‡ See Sect. ii. of this chapter.

150 Courtesy, good-neighbourhood, &c.

Courtesy, *good-neighbourhood*, *affability*, and the like duties, which are founded on our private social connections, are no less necessary and obligatory to creatures united in society, and supporting and supported by each other in a chain of mutual want and dependence. They do not consist in a smooth address, an artificial or obsequious air, fawning adulations, or a polite servility of manners; but in a just and modest sense of our own dignity and that of others, and of the reverence due to mankind, especially to those who hold the higher links of the social chain; in a discreet and manly accommodation of ourselves to the foibles and humours of others; in a strict observance of the rules of decorum and civility; but, above all, in a frank obliging carriage, and generous interchange of good deeds rather than words. Such a conduct is of great use and advantage, as it is an excellent security against injury, and the best claim and recommendation to the esteem, civility, and universal respect of mankind. This inferior order of virtues unite the particular members of society more closely, and forms the lesser pillars of the civil fabric; which, in many instances, supply the unavoidable defects of laws, and maintain the harmony and decorum of social intercourse, where the more important and essential lines of virtue are wanting.

151 Charity, forgiveness.

Charity and *foregiveness* are truly amiable and useful duties of the social kind. There is a twofold distinction of rights commonly taken notice of by moral writers, viz. *perfect* and *imperfect*. To fulfil the former, is necessary to the being and support of society; to fulfil the latter, is a duty equally sacred and obligatory, and tends to the improvement and prosperity of society; but as the violation of them is not equally prejudicial to the public good, the fulfilling them is not subjected to the cognizance of law, but left to the candour, humanity, and gratitude of individuals. And by this means ample scope is given to exercise all the generosity, and display the genuine merit and lustre, of virtue. Thus the wants and misfortunes of others call for our charitable assistance and seasonable supplies. And the good man, unconstrained by law, and uncontrouled by human authority, will cheerfully acknowledge and generously satisfy this mournful and moving claim; a claim supported by the sanction of heaven, of whose bounties he is honoured to be the grateful trustee. If his own *perfect* rights are invaded by the injustice of others, he will not therefore reject their *imperfect* right to pity and forgiveness, unless his grant of these should be inconsistent with the more extensive rights of society, or the public good. In that case he will have recourse to public justice and the laws, and even then he will prosecute the injury with no unnecessary severity, but rather with mildness and humanity. When the injury is merely personal, and of such a nature as to admit of alleviations, and the forgiveness of which would be attended with no worse consequences, especially of a public kind, the good man will generously forgive his offending brother. And it is his duty to do so, and not to take private revenge, or retaliate evil for evil. For though resentment of injury is a natural passion, and implanted, as was observed * above, for wise and good ends; yet, considering the manifold partialities which most men have for themselves, was every one to act as judge in his own cause, and to execute the sentence dictated by his own resentment, it is but too evident that mankind would pass all bounds in their fury, and the last sufferer be provoked in his turn to make full reprisals. So that evil, thus encountering with evil, would produce one continued series of violence and misery, and render society intolerable, if not impracticable. Therefore, where the security of the individual, or the good of the public, does not require a proportionable retaliation, it is agreeable to the general law of benevolence, and to the particular end of the passion (which is to prevent injury and the misery occasioned by it), to forgive personal injuries, or not to return evil for evil. This duty is one of the noble refinements which *Christianity* has made upon the general maxims and practice of mankind, and enforced, with a peculiar strength and beauty, by sanctions no less alluring than awful. And indeed the practice of it is generally its own reward; by expelling from the mind the most dreadful intruders upon its repose, those rancorous passions which are begot and nursed by resentment, and by disarming and even subduing every enemy one has, except such as have nothing left of men but the outward form.

* See Part I. chap. ii. and iv.

152 Hospitality.

The most enlarged and humane connection of the private kind seems to be the hospitable alliance, from which flow the amiable and disinterested duties we owe to strangers. If the exercise of passions of the most private and instinctive kind is beheld with moral approbation and delight, how lovely and venerable must those appear which result from a calm philanthropy, are founded in the common rights and connections of society, and embrace men, not of a particular sect, party, or nation, but all in general without distinction, and without any of the little partialities of self-love.

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SECT. VI. *Social duties of the* COMMERCIAL *kind.*

The next order of connections are those which arise from the wants and weakness of mankind, and from the various circumstances in which their different situations place them. These we may call *commercial* connections, and the duties which result from them *commercial* duties, as *justice*, *fair-dealing*, *sincerity*, *fidelity to compacts*, and the like.

153 Commercial duties.

154 Their foundation.

Though nature is perfect in all her works, yet she has observed a manifest and eminent distinction among them. To all such as lie beyond the reach of human skill and power, and are properly of her own department, she has given the finishing hand. These man may design after and imitate, but he can never rival them, nor add to their beauty or perfection. Such are the forms and structure of vegetables, animals, and many of their productions, as the honey-comb, the spider's web, and the like. There are others of her works which she has of design left unfinished, as it were, in order to exercise the ingenuity and power of man. She has presented to him a rich profusion of materials of every kind for his conveniency and use; but they are rude and unpolished, or not to be come at without art and labour. These therefore he must apply, in order to adapt them to his use, and to enjoy them in perfection. Thus nature has given him an infinite variety of herbs, grain, fossils, minerals, wood, water, earth, air, and a thousand other crude materials, to supply his numerous wants. But he must sow, plant, dig, refine, polish, build, and, in short, manufacture the various produce of nature, in order to obtain even the necessaries, and much more the conveniencies and elegancies of life. These then are the price of his labour and industry, and, without that, nature will sell him nothing. But as the wants of mankind are many, and the single strength of individuals small, they could hardly find the necessaries, and much less the conveniencies of life, without uniting their ingenuity and strength in acquiring these, and without a mutual intercourse of good offices. Some men are better formed for some kinds of ingenuity and labour, and others for other kinds; and different soils and climates are enriched with different productions; so that men, by exchanging the produce of their respective labours, and supplying the wants of one country with the superfluities of another, do in effect diminish the labours of each, and increase the abundance of all. This is the foundation of all commerce, or exchange of commodities and goods, one with another; in order to facilitate which, men have contrived different species of coin, or money, as a common standard by which to estimate the comparative values of their respective goods. But to render commerce sure and effectual, *justice*, *fair-dealing*, *sincerity*, and *fidelity to compacts*, are absolutely necessary.

155 Justice;

Justice or *fair dealing*, or, in other words, a disposition to treat others as we would be treated by them, is a virtue of the first importance, and inseparable from the virtuous character. It is the cement of society, or that pervading spirit which connects its members, inspires its various relations, and maintains the order and subordination of each part to the whole. Without it, society would become a den of thieves and banditti, hating and hated, devouring and devoured, by one another.

And here it may be proper to take a view of Mr Hume's supposed case of the sensible knave and the worthless miser (n° 16.), and consider what would be the duty of the former according to the theory of those moralists who hold the *will of God* to be the *criterion* or *rule*, and *everlasting happiness* the *motive*, of human virtue.

156 Universally duty on the principles of those who hold the will of God to be the criterion of virtue.

It has been already observed, and the truth of the observation cannot be controverted, that, by secretly purloining from the coffers of a miser part of that gold which there lies useless, a man might, in particular circumstances, promote the good of society, without doing any injury to a single individual: and it was hence inferred, that, in such circumstances, it would be no duty to abstain from theft, were *local utility* arising from *particular consequences* the real criterion or standard of justice. Very different, however, is the conclusion which must be drawn by those who consider the natural tendency of actions, if universally performed, as the criterion of their merit or demerit in the sight of God. Such philosophers attend, not to the particular consequences of a single action in any given case, but to the general consequences of the principle from which it flows, if that principle were universally adopted. You cannot (say they) permit one action and forbid another, without showing a difference between them. The same sort of actions, therefore, must be generally permitted or generally forbidden. But were every man allowed to ascertain for himself the circumstances in which the good of society would be promoted, by secretly abstracting the superfluous wealth of a worthless miser, it is plain that no property could be secure; that all incitements to industry would be at once removed; and that, whatever might be the *immediate* consequences of any *particular theft*, the *general* and *necessary* consequences of the *principle* by which it was authorized must soon prove fatal. Were one man to purloin part of the riches of a real miser, and to consider his conduct as vindicated by his intention to employ those riches in acts of generosity, another might by the same sort of casuistry think himself authorized to appropriate to himself part of his wealth; and thus theft would spread through all orders of men, till society were dissolved into separate, hostile, and savage families, mutually dreading and shunning each other. The general consequences, therefore, of encroaching upon private property tend evidently and violently to universal misery.

On the other hand, indeed, the particular and immediate consequences of that principle which considers every man's property as sacred, may in some cases, such as that supposed, be in a small degree injurious to a few families in the neighbourhood of the miser and the knave. But that injury can never be of long duration; and it is infinitely more than counterbalanced by the general good consequences of the principle from which it accidentally results; for these consequences extend to all nations and to all ages. Without a sacred regard to property, there could neither be arts nor industry nor confidence among men, and happiness would be for ever banished from this world. But the communication of happiness being the end

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which God had in view when he created the world, and all men ſtanding in the ſame relation to him, it is impoſſible to ſuppoſe that he does not approve, and will not ultimately reward, thoſe voluntary actions of which the natural tendency is to increaſe the ſum of human happineſs; or that he does not diſapprove, and will not ultimately puniſh, thoſe which naturally tend to aggravate human miſery. The concluſion is, that a ſtrict adherence to the principle of juſtice is univerſally, and in all poſſible circumſtances, a duty from which we cannot deviate without offending our Creator, and ultimately bringing miſery upon ourſelves.

157 Sincerity. *Sincerity*, or *veracity*, in our words and actions, is another virtue or duty of great importance to ſociety, being one of the great bands of mutual intercourſe, and the foundation of mutual truſt. Without it, ſociety would be the dominion of miſtruſt, jealouſy, and fraud, and converſation a traffic of lies and diſſimulation. It includes in it a conformity of our words with our ſentiments, a correſpondence between our actions and diſpoſitions, a ſtrict regard to truth, and an irreconcileable abhorrence of falſehood. It does not indeed require, that we expoſe our ſentiments indiſcreetly, or tell all the truth in every caſe; but certainly it does not and cannot admit the leaſt violation of truth or contradiction to our ſentiments. For if theſe bounds are once paſſed, no poſſible limit can be aſſigned where the violation ſhall ſtop, and no pretence of private or public good can poſſibly counterbalance the ill conſequences of ſuch a violation.

158 Fidelity to promiſes, compacts, &c. *Fidelity to promiſes, compacts*, and *engagements*, is likewiſe a duty of ſuch importance to the ſecurity of commerce and interchange of benevolence among mankind, that ſociety would ſoon grow intolerable without the ſtrict obſervance of it. Hobbes, and others who follow the ſame track, have taken a wonderful deal of pains to puzzle this ſubject, and to make all the virtues of this ſort merely *artificial*, and not at all *obligatory*, antecedent to human conventions. No doubt compacts ſuppoſe people who make them; and promiſes perſons to whom they are made; and therefore both ſuppoſe ſome ſociety, more or leſs, between thoſe who enter into theſe mutual engagements. But is not a compact or promiſe binding, till men have agreed that they ſhall be binding? or are they only binding, becauſe it is our intereſt to be bound by them, or to fulfil them? Do not we highly approve the man who fulfils them, even though they ſhould prove to be againſt his intereſt? and do not we condemn him as a knave who violates them on that account? A promiſe is a voluntary declaration by words, or by an action equally ſignificant, of our reſolution to do ſomething in behalf of another, or for his ſervice. When it is made, the perſon who makes it is by all ſuppoſed under an obligation to perform it. And he to whom it is made may demand the performance as his right. That perception of *obligation* is a ſimple idea, and is on the ſame footing as our other moral perceptions, which may be deſcribed by inſtances, but cannot be defined. Whether we have a perception of ſuch obligation quite diſtinct from the intereſt, either public or private, that may accompany the fulfilment of it, muſt be referred to the conſcience of every individual. And whether the mere ſenſe of that obligation, apart from its concomitants, is not a ſufficient inducement or motive to keep one's promiſe, without having recourſe to any ſelfiſh principle of our nature, muſt be likewiſe appealed to the conſcience of every honeſt man.

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It may, however, be not improper to remark, that in this, as in all other inſtances, our chief good is combined with our duty. "Men act from expectation ‡. Expectation is in moſt caſes determined by the aſſurances and engagements which we receive from others. If no dependence could be placed upon theſe aſſurances, it would be impoſſible to know what judgement to form of many future events, or how to regulate our conduct with reſpect to them. Confidence, therefore, in promiſes, is eſſential to the intercourſe of human life, becauſe without it the greateſt part of our conduct would proceed upon chance. But there could be no confidence in promiſes, if men were not obliged to perform them." Thoſe, therefore, who allow not to the perceptions of the moral ſenſe all that authority which we attribute to them, muſt ſtill admit the obligation to perform promiſes; becauſe ſuch performance may be ſhown to be agreeable to the will of God, in the very ſame manner in which upon their principles we have ſhown the uniform practice of juſtice to be ſo. 159 Shown to be duties independent of the authority of the moral ſenſe.

Fair-dealing and *fidelity* to *compacts* require that we take no advantage of the ignorance, paſſion, or incapacity of others, from whatever cauſe that incapacity ariſes;—that we be explicit and candid in making bargains, juſt and faithful in fulfilling our part of them. And if the other party violates his engagements, redreſs is to be ſought from the laws, or from thoſe who are intruſted with the execution of them. In fine, the *commercial* virtues and duties require that we not only do not invade, but maintain the rights of others;—that we be fair and impartial in transferring, bartering, or exchanging property, whether in goods or ſervice; and be inviolably faithful to our word and our engagements, where the matter of them is not criminal, and where they are not extorted by force. See Promise. 160 What thoſe duties require.

Sect. VII. *Social Duties of the* Political *Kind.*

We are now arrived at the laſt and higheſt order of duties reſpecting ſociety, which reſult from the exerciſe of the moſt generous and heroic affections, and are founded on our moſt enlarged connections.

The *ſocial* principle in man is of ſuch an expanſive nature, that it cannot be confined within the circuit of a family, of friends, or a neighbourhood; it ſpreads into wider ſyſtems, and draws men into larger confederacies, communities, and commonwealths. It is in theſe only that the higher powers of our nature attain the higheſt improvement and perfection of which they are capable. Theſe principles hardly find objects in the ſolitary ſtate of nature. *There* the principle of action riſes no higher at fartheſt than *natural affection* towards one's offspring. There perſonal or family wants entirely engroſs the creature's attention and labour, and allow no leiſure, or, if they did, no exerciſe for views and affections of a more enlarged kind. In *ſolitude* all are employed in the ſame way, in providing for the *animal* life. And even after their utmoſt labour and care, ſingle and unaided by the induſtry of others, they find but a ſorry ſupply of their wants, and a feeble precarious ſecurity againſt dangers from wild beaſts; from inclement ſkies and ſeaſons; 161 Political connections.

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sons; from the mistakes or petulant passions of their fellow-creatures; from their preference of themselves to their neighbours; and from all the little exorbitances of self-love. But in *society*, the mutual aids which men give and receive shorten the labours of each, and the combined strength and reason of individuals give security and protection to the whole body. There is both a variety and subordination of genius among mankind. Some are formed to lead and direct others, to contrive plans of happiness for individuals, and of government for communities, to take in a public interest, invent laws and arts, and superintend their execution, and, in short, to refine and civilize human life. Others, who have not such good heads, may have as honest hearts, a truly public spirit, love of liberty, hatred of corruption and tyranny, a generous submission to laws, order, and public institutions, and an extensive philanthropy. And others, who have none of those capacities either of heart or head, may be well formed for manual exercises and bodily labour. The former of these principles have no scope in solitude, where a man's thoughts and concerns do all either centre in himself or extend no farther than a family; into which little circle all the duty and virtue of the solitary mortal is crowded. But society finds proper objects and exercises for every genius, and the noblest objects and exercises for the noblest geniuses, and for the highest principles in the human constitution; particularly for that warmest and most divine passion which God hath kindled in our bosoms, the inclination of doing good, and reverencing our nature; which may find here both employment and the most exquisite satisfaction. In society, a man has not only more leisure, but better opportunities, of applying his talents with much greater perfection and success, especially as he is furnished with the joint advice and assistance of his fellow creatures, who are now more closely united one with the other, and sustain a common relation to the same moral system or community. This then is an object proportioned to his most enlarged social affections; and in serving it he finds scope for the exercise and refinement of his highest intellectual and moral powers. *Therefore society, or a state of civil government*, rests on these two principal pillars, "That in it we find security against those evils which are unavoidable in solitude —and obtain those goods, some of which cannot be obtained at all, and others not so well, in that state where men depend solely on their individual sagacity and industry."

From this short detail it appears, that *man* is a *social* creature, and formed for a *social* state; and that *society*, being adapted to the higher principles and destinations of his nature, must of necessity be his *natural* state.

162 Political duties.

The duties suited to that state, and resulting from those principles and destinations, or, in other words, from our social passions and social connections, or relation to a public system, are, *love of our country, resignation, and obedience to the laws, public spirit, love of liberty, sacrifice of life and all to the public, and the like.*

163 Love of one's country.

Love of our country, is one of the noblest passions that can warm and animate the human breast. It includes all the limited and particular affections to our parents, friends, neighbours, fellow-citizens, countrymen. It ought to direct and limit their more confined and partial actions within their proper and natural bounds, and never let them incroach on those sacred and first regards we owe to the great public to which we belong. Were we solitary creatures, detached from the rest of mankind, and without any capacity of comprehending a *public interest*, or without affections leading us to desire and pursue it, it would not be our duty to mind it, nor criminal to neglect it. But as we are PARTS of the *public system*, and are not only capable of taking in large views of its interests, but by the strongest affections connected with it, and prompted to take a share of its concerns, we are under the most sacred ties to prosecute its security and welfare with the utmost ardour, especially in times of public trial. This *love of our country* does not import an attachment to any particular soil, climate, or spot of earth, where perhaps we first drew our breath, though those *natural* ideas are often associated with the *moral* ones, and, like external signs or symbols, help to ascertain and bind them; but it imports an affection to that *moral system*, or *community*, which is governed by the same laws and magistrates, and whose several parts are variously connected one with the other, and all united upon the bottom of a common interest. Perhaps indeed every member of the community cannot comprehend so large an object, especially if it extends through large provinces, and over vast tracts of land; and still less can he form such an idea, if there is no *public*, *i. e.* if all are subject to the caprice and unlimited will of one man; but the preference the generality show to their native country, the concern and longing after it which they express when they have been long absent from it; the labours they undertake and sufferings they endure to save or serve it, and the peculiar attachment they have to their countrymen, evidently demonstrate that the passion is *natural*, and never fails to exert itself when it is fairly disengaged from foreign clogs, and is directed to its proper object. Wherever it prevails in its genuine vigour and extent, it swallows up all sordid and selfish regards; it conquers the love of *ease, power, pleasure*, and *wealth*; nay, when the amiable partialities of *friendship, gratitude, private affection*, or *regards to a family*, come in competition with it, it will teach us bravely to sacrifice all, in order to maintain the rights, and *promote* or *defend* the honour and happiness, of our country.

Resignation and *obedience to the laws* and *orders* of the society to which we belong, are *political* duties necessary to its very being and security, without which it must soon degenerate into a state of licentiousness and anarchy. The welfare, nay, the nature of civil society, requires, that there should be a subordination of orders, or diversity of ranks and conditions in it;—that certain men, or orders of men, be appointed to superintend and manage such affairs as concern the public safety and happiness;—that all have their particular provinces assigned them;—that such a subordination be settled among them as none of them may interfere with another; and finally, that certain *rules* or *common measures of action* be agreed on, by which each is to discharge his respective duty to govern or be governed, and all may concur in securing the order

164 Resignation and obedience to the laws, &c.

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der, and promoting the felicity, of the whole political body. Those *rules of action* are the *laws* of the community; and those different *orders* are the several officers or magistrates appointed by the public to explain them, and superintend or assist in their execution. In consequence of this settlement of things, it is the duty of each individual to obey the laws enacted; to submit to the executors of them with all due deference and homage, according to their respective ranks and dignity, as to the keepers of the public peace, and the guardians of public liberty; to maintain his own rank, and perform the functions of his own station, with diligence, fidelity, and incorruption. The superiority of the *higher* orders, or the authority with which the state has invested them, intitle them, especially if they employ their authority well, to the obedience and submission of the *lower*, and to a proportionable honour and respect from all. The subordination of the lower ranks claims protection, defence, and security from the higher. And the laws, being superior to all, require the obedience and submission of all, being the last resort, beyond which there is no decision or appeal.

165 Foundation of public spirit, love of liberty, &c.

Public spirit, heroic zeal, love of liberty, and the other *political* duties, do, above all others, recommend those who practise them to the admiration and homage of mankind; because, as they are the offspring of the noblest minds, so *are they* the parents of the greatest blessing to society. Yet, exalted as they are, it is only in equal and free governments where they can be exercised and have their due effect. For there only does a true *public spirit* prevail, and there only is the *public good* made the standard of the civil constitution. As the end of society is the *common interest* and *welfare* of the people associated, this end must of necessity be the *supreme law* or *common standard*, by which the particular rules of action of the several members of the society towards each other are to be regulated. But a *common interest* can be no other than that which is the result of the *common reason* or *common feelings* of all. Private men, or a particular order of men, have interests and feelings peculiar to themselves, and of which they may be good judges; but these may be separate from, and often contrary to, the interests and feelings of the rest of the society; and therefore they can have no right to make, and much less to impose, laws on their fellow-citizens, inconsistent with, and opposite to, those interests and those feelings. Therefore, a *society*, a *government*, or *real public*, truly worthy the name, and not a confederacy of banditti, a clan of lawless savages, or a band of slaves under the whip of a master, must be such a one as consists of freemen, chusing or consenting to laws themselves; or, since it often happens that they cannot assemble and act in a *collective body*, delegating a sufficient number of *representatives*, i. e. such a number as shall most fully comprehend, and most equally represent, their *common feelings* and *common interests*, to digest and vote laws for the conduct and controul of the whole body, the most agreeable to those common feelings and common interests.

166 Political duties of every citizen.

A society thus constituted by *common reason*, and formed on the plan of a *common interest*, becomes immediately an object of public attention, public veneration, public obedience, a public and inviolable attachment, which ought neither to be seduced by bribes, nor awed by terrors; an object, in fine, of all those extensive and important duties which arise from so glorious a confederacy. To watch over such a system; to contribute all he can to promote its good by his reason, his ingenuity, his strength, and every other ability, whether natural or acquired; to resist, and, to the utmost of his power, defeat every incroachment upon it, whether carried on by a secret corruption or open violence; and to sacrifice his ease, his wealth, his power, nay life itself, and, what is dearer still, his family and friends, to defend or save it, is the duty, the honour, the interest, and the happiness of every citizen; it will make him venerable and beloved while he lives, be lamented and honoured if he falls in so glorious a cause, and transmit his name with immortal renown to the latest posterity.

As the PEOPLE are the fountain of power and authority, the original seat of majesty, the authors of laws, and the creators of officers to execute them; if they shall find the power they have conferred abused by their trustees, their majesty violated by tyranny or by usurpation, their authority prostituted to support violence or screen corruption, the laws grown pernicious through accidents unforeseen or unavoidable, or rendered ineffectual through the infidelity and corruption of the executors of them; then it is their right, and what is their right is their duty, to resume that delegated power, and call their trustees to an account; to resist the usurpation, and extirpate the tyranny; to restore their sullied majesty and prostituted authority; to suspend, alter, or abrogate those laws, and punish their unfaithful and corrupt officers. Nor is it the duty only of the united body; but every member of it ought, according to his respective rank, power, and weight in the community, to concur in advancing and supporting these glorious designs. 167 Of the people.

Resistance, therefore, being undoubtedly lawful in extraordinary emergencies, the question, among good reasoners, can only be with regard to the degree of necessity which can justify resistance, and render it expedient or commendable. And here we must acknowledge, that, with Mr Hume *, "we shall always incline to their side that draw the bond of allegiance very close, and who consider an infringement of it as the last refuge in desperate cases, when the public is in the highest danger from violence and tyranny. For besides the mischiefs of a civil war, which commonly attends insurrection, it is certain, that where a disposition to rebellion appears among any people, it is one chief cause of tyranny in the rulers, and forces them into many violent measures, which, had every one been inclined to submission and obedience, they would never have embraced. Thus the *tyrannicide*, or assassination approved of by ancient maxims, instead of keeping tyrants and usurpers in awe, made them ten times more fierce and unrelenting; and is now justly abolished on that account by the laws of nations, and universally condemned, as a base and treacherous method of bringing to justice those disturbers of society."

* *Essays*, vol. i.

CHAP. IV. *Duty to* GOD.

168 Divine connections.

OF all the *relations* which the human mind sustains, that which subsists between the *Creator* and his *creatures*,

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tures, the ſupreme *Lawgiver* and his *ſubjects*, is the higheſt and the beſt. This relation ariſes from the *nature of a creature* in general, and the *conſtitution* of the *human mind* in particular; the nobleſt powers and affections of which point to an *univerſal* mind, and would be imperfect and abortive without ſuch a direction. How lame then muſt that ſyſtem of morals be, which leaves a *Deity* out of the queſtion! How diſconſolate, and how deſtitute of its firmeſt ſupport!

169 Exiſtence of God.

It does not appear, from any true hiſtory or experience of the mind's progreſs, that any man, by any formal deduction of his diſcurſive power, ever reaſoned himſelf into the belief of a God. Whether ſuch a belief is only ſome *natural anticipation* of ſoul, or is derived from father to ſon, and from one man to another, in the way of *tradition*, or is ſuggeſted to us in conſequence of an *immutable law of our nature*, on beholding the auguſt aſpect and beautiful order of the univerſe, we will not pretend to determine. What ſeems moſt agreeable to experience is, that a *ſenſe* of its *beauty* and *grandeur*, and the *admirable fitneſs* of one thing to another in its vaſt apparatus, leads the mind *neceſſarily* and *unavoidably* to a perception of a *deſign*, or of a *deſigning cauſe*, the origin of all, by a progreſs as ſimple and natural as that by which a *beautiful picture* or a *fine building* ſuggeſts to us the idea of an *excellent artiſt*. For it ſeems to hold univerſally true, that wherever we diſcern a *tendency* or *co-operation of things towards a certain end*, or producing a common effect, there, by a neceſſary *law of aſſociation*, we apprehend *deſign*, a *deſigning energy* or *cauſe*. No matter whether the objects are *natural* or *artificial*, ſtill that ſuggeſtion is unavoidable, and the *connection* between the *effect* and its *adequate cauſe* obtrudes itſelf on the mind, and it requires no nice ſearch or elaborate deduction of reaſon to trace or prove that connection. We are particularly ſatisfied of its truth in the ſubject before us by a kind of direct intuition; and we do not ſeem to attend to the maxim we learn in ſchools, "That there cannot be an *infinite ſeries* of *cauſes* and *effects* producing and produced by one another." That maxim is familiar only to metaphyſicians; but all men of ſound underſtanding are led to believe the exiſtence of a God. We are conſcious of our *exiſtence*, of *thought*, *ſentiment*, and *paſſion*, and ſenſible withal that theſe came not of ourſelves; therefore we immediately recogniſe a *parent-mind*, an *original intelligence*, from whom we borrowed thoſe little portions of thought and activity. And while we not only feel *kind* affections in ourſelves, and diſcover them in others, but likewiſe behold round us ſuch a number and variety of creatures, endued with natures nicely adjuſted to their ſeveral ſtations and œconomies, ſupporting and ſupported by each other, and all ſuſtained by a *common order* of things, and ſharing different degrees of happineſs according to their reſpective capacities, we are naturally and neceſſarily led up to the Father of ſuch a numerous offspring, the fountain of ſuch wide-ſpread happineſs. As we conceive this Being before all, above all, and greater than all, we naturally, and without reaſoning, aſcribe to him every kind of perfection, wiſdom, power, and

170 His relation to the human mind.

goodneſs without bounds, exiſting through all time, and pervading all ſpace. We apply to him thoſe glorious epithets of our *Creator*, *Preſerver*, *Benefactor*, the *ſupreme Lord* and *Lawgiver* of the whole ſociety of rational and intelligent creatures. Not only the imperfections and wants of our being and condition, but ſome of the nobleſt inſtincts and affections of our minds, connect us with this great and univerſal nature. The mind, in its progreſs from object to object, from one character and proſpect of beauty to another, finds ſome blemiſh or deficiency in each, and ſoon exhauſts or grows weary and diſſatiſfied with its ſubject; it ſees no character of excellency among men equal to that pitch of eſteem which it is capable of exerting; no object within the compaſs of human things adequate to the ſtrength of its affection: nor can it ſtay any where in this ſelf-expanſive progreſs, or find repoſe after its higheſt flights, till it arrives at a Being of unbounded greatneſs and worth, on whom it may employ its ſublimeſt powers without exhauſting the ſubject, and give ſcope to the utmoſt force and fulneſs of its love without ſatiety or diſguſt. So that the nature of this Being correſponds to the nature of man; nor can his intelligent and moral powers obtain their entire end, but on the ſuppoſition of ſuch a Being, and without a real ſympathy and communication with him. The native propenſity of the mind to reverence whatever is *great* and *wonderful* in nature, finds a proper object of homage in him who ſpread out the heavens and the earth, and who ſuſtains and governs the whole of things. The *admiration* of beauty, the *love* of order, and the *complacency* we feel in goodneſs, muſt riſe to the higheſt pitch, and attain the full vigour and joy of their operations, when they unite in him who is the ſum and ſource of all perfection.

171 Immorality of impiety.

It is evident from the ſlighteſt ſurvey of morals, that how punctual ſoever one may be in performing the duties which reſult from our relations to mankind, yet to be quite deficient in performing thoſe which ariſe from our *relation* to the *Almighty*, muſt argue a ſtrange perverſion of *reaſon* or depravity of *heart*. If imperfect degrees of worth attract our veneration, and if the want of it would imply an inſenſibility, or, which is worſe, an averſion to merit, what lameneſs of affection or immorality of character muſt it be to be unaffected with, and much more to be ill-affected to, a Being of ſuperlative worth! To love ſociety, or particular members of it, and yet to have no ſenſe of our connection with its Head, no affection to our common Parent and Benefactor; to be concerned about the approbation or cenſure of our fellow-creatures, and yet to feel nothing of this kind towards him who ſees and weighs our actions with unerring wiſdom and juſtice, and can fully reward or puniſh them, betrays equal madneſs and partiality of mind. It is plain, therefore, beyond all doubt, that ſome regards are due to the great Father of all, in whom every lovely and adorable quality combines to inſpire veneration and homage.

172 Right opinions of God.

As it has been obſerved already, that our *affections* depend on our *opinions* of their objects, and generally keep pace with them, it muſt be of the higheſt importance, and ſeems to be among the firſt duties we owe to the Author of our being, "to form the leaſt imperfect, ſince we cannot form perfect, conceptions of his *character* and *adminiſtration*." For ſuch *conceptions*, thoroughly imbibed, will render our *religion* rational, and our *diſpoſitions* refined. If our *opinions* are diminutive and diſtorted, our religion will be ſuperſtitious,

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stitious, and our temper abject. Thus, if we ascribe to the Deity that false majesty which consists in the unbenevolent and sullen exercise of mere *will* or *power*, or suppose him to delight in the prostrations of servile fear, or as servile praise, he will be worshipped with mean adulation and a profusion of compliments. Farther, if he be looked upon as a stern and implacable Being, delighting in vengeance, he will be adored with pompous offerings, sacrifices, or whatever else may be thought proper to soothe and mollify him. But if we believe *perfect goodness* to be the character of the supreme Being, and that he loves those most who resemble him most, the worship paid him will be rational and sublime, and his worshippers will seek to please him by imitating that goodness which they adore.

173 Rational faith. The foundation then of all true religion is a *rational faith*. And of a rational faith these seem to be the chief articles, to believe, "that an infinite all perfect Mind exists, who has no opposite nor any separate interest from that of his creatures;—that he superintends and governs all creatures and things;—that his goodness extends to all his creatures, in different degrees indeed, according to their respective natures, but without any partiality or envy;—that he does every thing for the best, or in a subserviency to the perfection and happiness of the whole; particularly that he directs and governs the affairs of men, inspects their actions, distinguishes the *good* from the *bad*, loves and befriends the former, is displeased with and pities the latter in *this* world, and will according to their respective deserts reward one and punish the other in the next;—that, in fine, he is always carrying on a scheme of virtue and happiness through an unlimited duration; and is ever guiding the universe, through its successive stages and periods, to higher degrees of perfection and felicity." This is true *Theism*, the glorious scheme of divine faith; a scheme exhibited in all the works of God, and executed through his whole administration.

174 Morality of theism. This faith, well-founded and deeply felt, is nearly connected with a *true moral taste*, and hath a powerful efficacy on the temper and manners of the theist. He who admires goodness in others, and delights in the practice of it, must be conscious of a reigning order within, a rectitude and candour of heart, which disposes him to entertain favourable apprehensions of men, and, from an impartial survey of things, to presume that *good order* and *good meaning* prevail in the universe; and if good meaning and good order, then an *ordering*, an *intending mind*, who is no enemy, no tyrant to his creatures, but a *friend*, a *benefactor*, an *indulgent sovereign*.

175 Immorality of atheism. On the other hand, a bad man, having nothing goodly or generous *to contemplate within*, no right intentions, nor honesty of heart, suspects every person and every thing; and, beholding nature through the gloom of a selfish and guilty mind, is either averse to the belief of a reigning order, or, if he cannot suppress the unconquerable anticipations of a governing mind, he is prone to tarnish the beauty of nature, and to impute malevolence, or blindness and impotence at least, to the Sovereign Ruler. He turns the universe into a forlorn and horrid waste, and transfers his own character to the Deity, by ascribing to him that uncommunicative grandeur, that arbitrary or revengeful spirit, which he affects or admires in himself. As such a temper of mind naturally leads to *atheism*, or to a *superstition* full as bad; therefore, as far as that temper depends on the unhappy creature on whom it prevails, the propensity to atheism or superstition consequent thereto must be *immoral*. Farther, if it be true that the belief or sense of a Deity is natural to the mind, and the evidence of his existence reflected from his works so full as to strike even the most superficial observer with conviction, then the supplanting or corrupting that sense, or the want of due attention to that evidence, and, in consequence of both, a supine ignorance or affected unbelief of a Deity, must argue a bad temper or an immoral turn of mind. In the case of invincible ignorance, or a very bad education, tho' nothing can be concluded directly against the character; yet whenever ill passions and habits pervert the judgment, and by perverting the judgment terminate in atheism, then the case becomes plainly criminal.

But let casuists determine this as they will, a true faith in the divine character and administration is generally the consequence of a virtuous state of mind. 176 The connection of theism and virtue. The man who is truly and habitually good, feels the *love of order*, of *beauty*, and *goodness*, in the strongest degree; and therefore cannot be insensible to those emanations of them which appear in all the works of God, nor help loving their supreme source and model. He cannot but think, that he who has poured such beauty and goodness over all his works, must himself delight in beauty and goodness, and what he delights in must be both amiable and happy. Some indeed there are, and it is pity there should be any such, who, through the unhappy influence of a wrong education, have entertained dark and unfriendly thoughts of a Deity and his administration, though otherwise of a virtuous temper themselves. However, it must be acknowledged, that such sentiments have, for the most part, a bad effect on the temper; and when they have not, it is because the undepraved affections of an honest *heart* are more powerful in their operation than the speculative opinions of an ill informed *head*.

But wherever right conceptions of the Deity and his 177 Duties of gratitude, love, &c. providence prevail, when he is considered as the inexhausted source of light, and love, and joy, as acting in the joint character of a *Father* and *Governor*, imparting an endless variety of capacities to his creatures, and supplying them with every thing necessary to their full completion and happiness; what veneration and gratitude must such conceptions, thoroughly believed, excite in the mind? How natural and delightful must it be to one whose heart is open to the perception of truth, and of every thing *fair*, *great*, and *wonderful* in nature, to contemplate and adore him who is the first *fair*, the first *great*, and first *wonderful*; in whom *wisdom*, *power*, and *goodness*, dwell vitally, essentially, originally, and act in perfect concert? What *grandeur* is here to fill the most enlarged capacity, what *beauty* to engage the most ardent love, what a mass of *wonders* in such exuberance of perfection to astonish and delight the human mind through an unfailing duration!

If the *Deity* is considered as our supreme *Guardian* 178 Other affections. and *Benefactor*, as the *Father of Mercies*, who loves his creatures with infinite tenderness, and in a particular manner all good men, nay all who delight in goodness, even in its most imperfect degrees; what resignation,

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nation, what dependence, what generous confidence, what hope in God and his all-wiſe providence, muſt ariſe in the ſoul that is poſſeſſed of ſuch amiable views of him? All thoſe exerciſes of piety, and above all a ſuperlative eſteem and love, are directed to God as to their *natural*, their *ultimate*, and indeed their only *adequate* object; and though the immenſe obligations we have received from him may excite in us more lively feelings of divine goodneſs than a general and abſtracted contemplation of it, yet the affections of *gratitude* and *love* are of themſelves of the generous diſintereſted kind, not the reſult of ſelf-intereſt, or views of reward. A perfect character, in which we always ſuppoſe infinite goodneſs, guided by unerring wiſdom, and ſupported by almighty power, is the proper object of perfect love; which, as ſuch, we are forcibly drawn to purſue and to aſpire after. In the contemplation of the divine nature and attributes, we find at laſt what the ancient philoſophers ſought in vain, the SUPREME AND SOVEREIGN GOOD; from which all other goods ariſe, and in which they are all contained. The Deity therefore challenges our ſupreme and ſovereign love, a ſentiment which, whoſoever indulges, muſt be confirmed in the love of virtue, in a deſire to imitate its all-perfect pattern, and in a cheerful ſecurity that all his great concerns, thoſe of his friends and of the univerſe, ſhall be abſolutely ſafe under the conduct of unerring wiſdom and unbounded goodneſs. It is in his care and providence alone that the good man, who is anxious for the happineſs of all, finds perfect ſerenity; a ſerenity neither ruffled by partial ill nor ſoured by private diſappointment.

179 Repentance &c. When we conſider the unſtained purity and abſolute perfection of the *divine* nature, and reflect withal on the imperfection and various blemiſhes of our own, we muſt ſink, or be convinced we ought to ſink, into the deepeſt humility and proſtration of ſoul before him who is ſo wonderfully great and holy. When, further, we call to mind what low and languid feelings we have of the divine preſence and majeſty, what inſenſibility of his fatherly and univerſal goodneſs, nay, what ungrateful returns we have made to it, how far we come ſhort of the perfection of his law and the dignity of our own nature, how much we have indulged to the ſelfiſh paſſions, and how little to the benevolent ones; we muſt be conſcious that it is our duty to repent of a temper and conduct ſo unworthy our nature and unbecoming our obligations to its Author, and to reſolve and endeavour to act a wiſer and better part for the future.

180 Hopes of pardon. Nevertheleſs, from the character which his works exhibit of him, from thoſe delays or alleviations of puniſhment which offenders often experience, and from the merciful tenor of his adminiſtration in many other inſtances, the ſincere penitent may entertain good hopes that his Parent and Judge will not be ſtrict to mark iniquity, but will be propitious and favourable to him, if he honeſtly endeavours to avoid his former practices, and ſubdue his former habits, and to live in a greater conformity to the divine will for the future. If any doubts or fears ſhould ſtill remain, how far it may be conſiſtent with the rectitude and equity of the divine government to let his iniquities paſs unpuniſhed, yet he cannot think it unſuitable to his paternal clemency and wiſdom to contrive a method of retrieving the penitent offender, that ſhall unite and reconcile the majeſty and mercy of his government. If reaſon cannot of itſelf ſuggeſt ſuch a ſcheme, it gives at leaſt ſome ground to expect it. But though *natural religion* cannot let in moral light and aſſurance on ſo intereſting a ſubject, yet it will teach the humble theiſt to wait with great ſubmiſſion for any farther intimations it may pleaſe the ſupreme Governor to give of his will; to examine with candour and impartiality whatever evidence ſhall be propoſed to him of a *divine revelation*, whether that evidence is *natural* or *ſupernatural*; to embrace it with veneration and cheerfulneſs, if the evidence is clear and convincing; and finally, if it bring to light any *new relations* or *connections*, *natural religion* will perſuade its ſincere votary faithfully to comply with the *obligations*, and perform the *duties* which reſult from thoſe relations and connections. This is *theiſm*, *piety*, the *completion of morality!*

181 Worſhip, praiſe, thankſgiving. We muſt farther obſerve, that all thoſe affections which we ſuppoſed to regard the Deity as their *immediate* and *primary* object, are vital energies of the ſoul, and conſequently exert themſelves into act, and, like all other energies, gain ſtrength or greater activity by that exertion. It is therefore our *duty* as well as higheſt *intereſt*, often at ſtated times, and by decent and ſolemn acts, to contemplate and adore the great Original of our exiſtence, the Parent of all beauty and of all good; to expreſs our veneration and love by an awful and devout recognition of his perfections; and to evidence our gratitude by celebrating his goodneſs, and thankfully acknowledging all his benefits. It is likewiſe our duty, by proper exerciſes of ſorrow and humiliation, to confeſs our ingratitude and folly; to ſignify our dependence on God, and our confidence in his goodneſs, by imploring his bleſſing and gracious concurrence in aſſiſting the weakneſs and curing the corruptions of our nature; and finally, to teſtify our ſenſe of his authority, and our faith in his government, by devoting ourſelves to do his will, and reſigning ourſelves to his diſpoſal. Theſe duties are not therefore obligatory, becauſe the Deity needs or can be profited by them; but as they are apparently *decent* and *moral*, ſuitable to the relations he ſuſtains of our *Creator*, *Benefactor*, *Lawgiver*, and *Judge*; expreſſive of our ſtate and obligations; and improving to our tempers, by making us more rational, ſocial, god-like, and conſequently more happy.

182 External worſhip. We have now conſidered INTERNAL piety, or the *worſhip of the mind*, that which is in ſpirit and in truth; we ſhall conclude the ſection with a ſhort account of that which is EXTERNAL. *External* worſhip is founded on the ſame principles as *internal*, and of as ſtrict moral obligation. It is either *private* or *public*. *Devotion* that is *inward*, or *purely intellectual*, is too ſpiritual and abſtracted an operation for the bulk of mankind. The operations of their minds, ſuch eſpecially as are employed on the moſt ſublime, immaterial objects, muſt be aſſiſted by their outward organs, or by ſome help from the imagination; otherwiſe they will ſoon be diſſipated by ſenſible impreſſions, or grow tireſome if too long continued. Ideas are ſuch fleeting things, that they muſt be fixed; and ſo ſubtle, that they muſt be expreſſed and delineated, as it were, by ſenſible marks and images; otherwiſe we cannot

 attend

Duty to God. attend to them, nor be much affected by them. *Therefore verbal adoration, prayer, praiſe, thankſgiving*, and *confeſſion*, are admirable aids to *inward* devotion, fix our attention, compoſe and enliven our thoughts, impreſs us more deeply with a ſenſe of the awful preſence in which we are, and, by a natural and mechanical ſort of influence, tend to heighten thoſe devout feelings and affections which we ought to entertain, and after this manner reduce into formal and explicit act.

183 Public worſhip. This holds true in an higher degree in the caſe of *public* worſhip, where the preſence of our fellow-creatures, and the powerful contagion of the *ſocial* affections, conſpire to kindle and ſpread the devout flame with greater warmth and energy. To conclude: As *God* is the *parent* and *head* of the *ſocial ſyſtem*, as he has formed us for a *ſocial ſtate*, as by *one* we find the beſt ſecurity againſt the ills of life, and in the *other* enjoy its greateſt comforts, and as, by means of *both*, our nature attains its higheſt improvement and perfection; and moreover, as there are *public bleſſings* and *crimes* in which we all ſhare in ſome degree, and *public wants* and *dangers* to which all are expoſed—it is therefore evident, that the various and ſolemn offices of *public religion* are duties of indiſpenſable moral obligation, among the beſt cements of ſociety, the firmeſt prop of government, and the faireſt ornament of both. Duty to God.

PART III.

CHAP. I. *Of* PRACTICAL ETHICS, *or the* CULTURE *of the* MIND.

184 Dignity and importance of the ſubject. WE have now gone through a particular detail of the ſeveral duties we owe to OURSELVES, to SOCIETY, and to GOD. In conſidering the *firſt order* of duties, we juſt touched on the methods of acquiring the different kinds of goods which we are led by nature to purſue; only we left the conſideration of the method of acquiring the *moral* goods of the mind to a chapter by itſelf, becauſe of its ſingular importance. This chapter then will contain a brief enumeration of the arts of acquiring *virtuous habits*, and of eradicating *vicious ones*, as far as is conſiſtent with the brevity of ſuch a work: a ſubject of the utmoſt difficulty as well as importance in morals; to which, nevertheleſs, the leaſt attention has been generally given by *moral* writers. This will properly follow a detail of duty, as it will direct us to ſuch *means* or *helps* as are moſt neceſſary and conducive to the practice of it.

185 Senſible ideas and ſenſible taſte. In the firſt part of this inquiry we traced the order in which the paſſions ſhoot up in the different periods of human life. That order is not accidental, or dependent on the caprice of men, or the influence of cuſtom and education, but ariſes from the original conſtitution and laws of our nature; of which this is one, viz. "That ſenſible objects make the firſt and ſtrongeſt impreſſions on the mind." Theſe, by means of our outward organs, being conveyed to the mind, become objects of its attention, on which it reflects when the outward objects are no longer preſent, or, in other words, when the impreſſions upon the outward organs ceaſe. Theſe objects of the mind's reflection are called *ideas* or *notions*. Towards theſe, by another law of our nature, we are not altogether indifferent; but correſpondent movements of *deſire* or *averſion*, *love* or *hatred*, ariſe, according as the objects which they denote made an agreeable or diſagreeable impreſſion on our organs. Thoſe *ideas* and *affections* which we experience in the *firſt* period of life, we refer to the *body*, or to *ſenſe*; and the *taſte* which is formed towards them, we call a *ſenſible*, or a merely *natural taſte*; and the objects correſponding to them we in general call *good* or *pleaſant*.

But as the mind moves forward in its courſe, it extends its views, and receives a new and more *complex* ſet of ideas, in which it obſerves *uniformity, variety, ſimilitude, ſymmetry of parts, reference to an end, novelty, grandeur*. Theſe compoſe a vaſt train and diverſity of *imagery*, which the mind compounds, divides, and moulds into a thouſand forms, in the abſence of thoſe objects which firſt introduced it. And this more complicated imagery ſuggeſts a new train of *deſires* and *affections*, full as ſprightly and engaging as any which have yet appeared. This whole claſs of *perceptions* or *impreſſions* is referred to the *imagination*, and forms an higher taſte than the *ſenſible*, and which has an immediate and mighty influence on the *finer* paſſions of our nature, and is commonly termed a *fine taſte*. 186 Ideas of beauty and a fine taſte.

The objects which correſpond to this taſte we uſe to call *beautiful, great, harmonious*, or *wonderful*, or in general by the name of *beauty*.

The mind, ſtill puſhing onwards and increaſing its ſtock of ideas, aſcends from thoſe to an higher ſpecies of objects, viz. the *order* and *mutual relations* of *minds* to each other, their reciprocal *affections, characters, actions*, and various *aſpects*. In theſe it diſcovers a *beauty*, a *grandeur*, a *decorum*, more intereſting and alluring than in any of the former kinds. Theſe objects, or the notions of them, paſſing in review before the mind, do, by a neceſſary law of our nature, call forth another and nobler ſet of affections, as *admiration, eſteem, love, honour, gratitude, benevolence*, and others of the like tribe. This claſs of *perfections*, and their correſpondent *affections*, we refer, becauſe of their objects *(manners)*, to a *moral* ſenſe, and call the *taſte* or *temper* they excite, *moral*. And the objects which are agreeable to this *taſte* or *temper* we denominate by the general name of *moral beauty*, in order to diſtinguiſh it from the other, which is termed *natural*. 187 Moral ideas and a moral taſte.

Theſe different ſets of *ideas* or *notions* are the materials about which the mind employs itſelf, which it blends, ranges, and diverſifies ten thouſand different ways. It feels a ſtrong propenſion to connect and aſſociate thoſe ideas among which it obſerves any *ſimilitude* or any *aptitude*, whether *original* and *natural*, or *cuſtomary* and *artificial*, to ſuggeſt each other. See METAPHYSICS. 188 Sources of aſſociation.

But whatever the reaſons are, whether *ſimilitude, co-exiſtence, cauſality*, or any other *aptitude* or *relation*, why any two or more ideas are connected by the mind at firſt, it is an eſtabliſhed law of our nature, "that when two or more ideas have often ſtarted in company, 189 Laws of aſſociation.

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company, they form ſo ſtrong an union, that it is very difficult ever after to ſeparate them." Thus the *lover* cannot ſeparate the idea of *merit* from his *miſtreſs;* the *courtier* that of *dignity* from his *title* or *ribbon;* the *miſer* that of *happineſs* from his *bags.* It is theſe aſſociations of *worth* or *happineſs* with any of the different ſets of *objects* or *images* before ſpecified, that form our *taſte* or *complex idea* of *good.* By another law of our nature, "our *affections* follow and are governed by this *taſte.* And to theſe *affections* our *character* and *conduct* are ſimilar and proportioned; on the general tenor of which our *happineſs* principally depends."

190 Leading paſſions follow taſte.

As all our *leading* paſſions then depend on the direction which our *taſte* takes, and as it is always of the ſame ſtrain with our *leading* aſſociations, it is worth while to inquire a little more particularly how theſe are formed, in order to detect the ſecret ſources from whence our paſſions derive their principal ſtrength, their various riſes and falls. For this will give us the true key to their management, and let us into the right method of correcting the *bad* and improving the *good.*

191 The importance and uſe of the imagination.

No kind of objects make ſo powerful an impreſſion on us as thoſe which are immediately impreſſed on our *ſenſes*, or ſtrongly painted on our *imaginations.* Whatever is purely *intellectual*, as abſtracted or ſcientific truths, the ſubtle relations and differences of things, has a fainter ſort of exiſtence in the mind; and though it may exerciſe and whet the *memory*, the *judgment*, or the *reaſoning power*, gives hardly any impulſe at all to the *active* powers, the *paſſions*, which are the main ſprings of motion. On the other hand, were the mind entirely under the direction of *ſenſe*, and impreſſible only by ſuch objects as are preſent, and ſtrike ſome of the outward organs, we ſhould then be preciſely in the ſtate of the brute creation, and be governed ſolely by *inſtinct* or *appetite*, and have no power to controul whatever impreſſions are made upon us: Nature has therefore endued us with a *middle faculty*, wonderfully adapted to our *mixed* ſtate, which holds partly of *ſenſe* and partly of *reaſon*, being ſtrongly allied to the *former*, and the common receptacle in which all the notices that come from that quarter are treaſured up; and yet greatly ſubſervient and miniſterial to the *latter*, by giving a body, a coherence, and beauty to its conceptions. This *middle* faculty is called the *imagination*, one of the moſt buſy and fruitful powers of the mind. Into this common ſtorehouſe are likewiſe carried all thoſe *moral forms* which are derived from our *moral faculties* of perception; and there they often undergo new changes and appearances, by being mixed and wrought up with the ideas and forms of *ſenſible* or *natural* things. By this coalition of imagery, *natural beauty* is dignified and heightened by *moral qualities* and *perfections*, and *moral qualities* are at once exhibited and ſet off by *natural beauty.* The *ſenſible* beauty, or good, is refined from its droſs by partaking of the *moral;* and the *moral* receives a ſtamp, a viſible character and currency, from the *ſenſible.*

192 Its energy in various inſtances in heightening ſenſible pleaſures.

As we are firſt of all accuſtomed to *ſenſible* impreſſions and *ſenſible* enjoyments, we contract early a *ſenſual reliſh* or *love of pleaſure*, in the lower ſenſe of the word. In order, however, to juſtify this reliſh, the mind, as it becomes open to *higher* perceptions of *beauty* and *good*, borrows from thence a noble ſet of *images*, as *fine taſte*, *generoſity*, *ſocial affections*, *friendſhip*, *good fellowſhip*, and the like; and, by dreſſing out the old purſuits with theſe new ornaments, gives them an additional dignity and luſtre. By theſe ways the *deſire of a table*, *love of finery*, *intrigue*, and *pleaſure*, are vaſtly increaſed beyond their natural pitch, having an impulſe combined of the force of the *natural* appetites, and of the ſuperadded ſtrength of thoſe *paſſions* which tend to the *moral ſpecies.* When the mind becomes more ſenſible to thoſe objects or appearances in which it perceives *beauty*, *uniformity*, *grandeur*, and *harmony*, as fine cloaths, elegant furniture, plate, pictures, gardens, houſes, equipage, the beauty of animals, and particularly the attractions of the ſex; to theſe objects the mind is led by *nature* or taught by *cuſtom*, the *opinion* and example of others, to annex certain ideas of *moral character*, *dignity*, *decorum*, *honour*, *liberality*, *tenderneſs*, and *active* or *ſocial enjoyment.* The conſeqence of this aſſociation is, that the objects to which theſe are annexed muſt riſe in their value, and be purſued with proportionable ardour. The *enjoyment* of them is often attended with *pleaſure;* and the mere *poſſeſſion* of them, where that is wanting, frequently draws reſpect from one's fellow-creatures: This *reſpect* is, by many, thought equivalent to the pleaſure of *enjoyment.* Hence it happens that the idea of *happineſs* is connected with the mere *poſſeſſion*, which is therefore eagerly ſought after, without any regard to the *generous uſe* or *honourable enjoyment.* Thus the paſſion, reſting on the *means*, not the *end*, i. e. loſing ſight of its *natural* object, becomes wild and extravagent.

193 In heightening the pleaſures of beauty, harmony, &c.

194 In raiſing the value of external ſymbols, &c.

In fine, any *object*, or *external denomination*, a *ſtaff*, a *garter*, a *cup*, a *crown*, a *title*, may become a *moral* badge or emblem of *merit*, *magnificence*, or *honour*, according as theſe have been found or thought, by the poſſeſſors or admirers of them, to accompany them; yet, by the deception formerly mentioned, the *merit* or the *conduct* which intitled, or ſhould intitle, to thoſe marks of diſtinction, ſhall be forgot or neglected, and the *badges* themſelves be paſſionately affected or purſued, as including every excellency. If theſe are attained by any means, all the concomitants which *nature*, *cuſtom*, or *accidents* have joined to them, will be ſuppoſed to follow of courſe. Thus, *moral ends*, with which the unhappy admirer is apt to colour over his paſſion and views, will, in his opinion, juſtify the moſt *immoral means*, as *proſtitution*, *adulation*, *fraud*, *treachery*, and every ſpecies of *knavery*, whether more open or more diſguiſed.

195 In heightening the value of wealth, power, &c.

When men are once engaged in *active* life, and find that *wealth* and *power*, generally called INTEREST, are the great avenues to every kind of enjoyment, they are apt to throw in many engaging *moral forms* to the object of their purſuit, in order to juſtify their paſſion, and varniſh over the meaſures they take to gratify it, as *independency on the vices* or *paſſions* of others, *proviſion* and *ſecurity to themſelves* and *friends*, *prudent œconomy*, or *well-placed charity*, *ſocial communication*, *ſuperiority to their enemies*, who are all villains, *honourable ſervice*, and many other ingredients of *merit.* To attain ſuch capacities of *uſefulneſs* or *enjoyment*, what arts, nay what meanneſſes, can be thought blameable by thoſe cool purſuers of intereſt?—Nor have they whom the gay world is pleaſed to indulge with

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with the title of *men of pleasure*, their imaginations less pregnant with *moral images*, with which they never fail to ennoble, or, if they cannot do that, to palliate their gross pursuits. Thus *admiration of wit*, of *sentiments* and *merit*, *friendship*, *love*, *generous sympathy*, *mutual confidence*, *giving* and *receiving pleasure*, are the ordinary ingredients with which they season their gallantry and pleasurable entertainments; and by which they impose on themselves, and endeavour to impose on others, that *their amours* are the joint issue of good sense and virtue.

196 Its influence on all the passions.

These *associations*, variously combined and proportioned by the *imagination*, form the chief *private* passions, which govern the lives of the generality, as the *love of action*, of *pleasure*, *power*, *wealth*, and *fame*; they influence the *defensive*, and affect the *public passions*, and raise *joy* or *sorrow* as they are gratified or disappointed. So that in effect these associations of *good* and *evil*, *beauty* and *deformity*, and the passions they raise, are the main *hinges of life* and *manners*, and the great *sources* of our *happiness* or *misery*. It is evident, therefore, that the whole of *moral culture* must depend on giving a right direction to the *leading passions*, and duly proportioning them to the *value* of the *objects* or *goods* pursued, under what name soever they may appear.

197 Moral culture, by correcting our taste or imagination.

Now, in order to give them this *right direction* and *due proportion*, it appears, from the foregoing detail, that those *associations* of ideas, upon which the passions depend, must be *duly* regulated; that is to say, as an exorbitant passion for *wealth*, *pleasure*, or *power*, flows from an *association* or *opinion* that more *beauty* and *good*, whether *natural* or *moral*, enters into the enjoyment or possession of them, than really belongs to either; *therefore*, in restoring those passions to their just proportion, we must begin with correcting the *opinion*, or breaking the *false association*, or, in other words, we must decompound the *complex phantom* of *happiness* or *good*, which we fondly admire; disunite those ideas that have no natural alliance; and separate the *original* idea of *wealth*, *power*, or *pleasure*, from the foreign mixtures incorporated with it, which enhance its value, or give it its chief power to enchant and seduce the mind. For instance, let it be considered how poor and inconsiderable a thing *wealth* is, if it be disjoined from *real use*, or from ideas of *capacity* in the possessor *to do good*, from *independency*, *generosity*, *provision for a family* or *friends*, and *social communication* with others. By this *standard* let its true value be fixed; let its misapplication, or unbenevolent enjoyment, be accounted sordid and infamous; and nothing worthy or estimable be ascribed to the *mere possession* of it, which is not borrowed from its *generous use*.

198 By self denial, and a counter-process.

If that *complex* form of *good* which is called *pleasure* engage us, let it be analysed into its constituent principles, or those allurements it draws from the *heart* and *imagination*, in order to heighten the low part of the indulgence; let the *separate* and *comparative* moment of each be distinctly ascertained and deduced from that gross part, and this remainder of the accumulated enjoyment will dwindle down into a poor, insipid, transitory thing. In proportion as the *opinion* of the *good* pursued abates, the *admiration* must decay, and the *passions* lose strength of course. One effectual way to lower the *opinion*, and consequently to weaken the habit founded upon it, is to practise lesser pieces of self-denial, or to abstain, to a certain pitch, from the pursuit or enjoyment of the favourite object; and, that this may be the more easily accomplished, one must avoid those occasions, that company, those places, and the other circumstances, that enflamed *one* and endeared the *other*. And, as a *counter-process*, let *higher* or even *different* enjoyments be brought in view, other passions played upon the former, different places frequented, other exercises tried, company kept with persons of a different or more correct way of thinking, both in *natural* and *moral* subjects.

199 By a sound and natural education.

As much depends on our setting out well in life, let the *youthful* fancy, which is apt to be very florid and luxuriant, be early accustomed by *instruction*, *example*, and significant *moral exercises*, nay, by looks, gestures, and every other testimony of just approbation or blame, to annex ideas of *merit*, *honour*, and *happiness*, not to *birth*, *dress*, *rank beauty*, *fortune*, *power*, *popularity*, and the like *outward* things, but to *moral* and *truly virtuous qualities*, and to those *enjoyments* which spring from a well-informed judgment and a regular conduct of the affections, especially those of the *social* and *disinterested* kind. Such dignified forms of *beauty* and *good*, often suggested, and, by moving pictures and examples, warmly recommended to the *imagination*, enforced by the authority of *conscience*, and demonstrated by *reason* to be the surest means of enjoyment, and the only independent, undeprivable, and durable goods, will be the best counterbalance to meaner passions, and the firmest foundation and security to virtue.

200 By rightly studying human nature.

It is of great importance to the forming a *just taste*, or pure and large conceptions of happiness, to study and understand *human nature* well, to remember what a complicated system it is, particularly to have deeply imprinted on our mind that GRADATION of *senses*, *faculties*, and *powers of enjoyment* formerly mentioned, and the *subordination* of *goods* resulting from thence, which nature points out, and the experience of mankind confirms. Who, when they think seriously, and are not under the immediate influence of some violent prejudice or passion, prefer not the pleasures of *action*, *contemplation*, *society*, and most *exercises* and *joys* of the *moral* kind, as *friendship*, *natural affection*, and the like, to all *sensual* gratifications whatsoever? Where the different species of pleasure are blended into *one complex form*, let them be accurately distinguished, and be referred each to its proper *faculty* and *sense*, and examined apart what they have peculiar, what common with others, and what foreign and adventitious.

201 By comparing the moment and abatements of different goods.

Let *wealth*, *grandeur*, *luxury*, *love*, *fame*, and the like, be tried by this test, and their true alloy will be found out. Let it be farther considered, whether the mind may not be easy and enjoy itself greatly, though it want many of those elegancies and superfluities of life which some possess, or that load of wealth and power which others eagerly pursue, and under which they groan. Let the difficulty of attaining, the precariousness of possessing, and the many abatements in enjoying overgrown wealth and envied greatness, of which the weary possessors so frequently complain, as the hurry of business, the burden of company, of paying attendance to the *few*, and giving it to the *many*, the cares of keeping, the fears of

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of loſing, and the deſires of increaſing what they have, and the other troubles which accompany this pitiful drudgery and pompous ſervitude; let theſe and the like circumſtances be often conſidered, that are conducive to the removing or leſſening the *opinion* of ſuch goods, and the attendant *paſſion* or *ſet* of *paſſions* will decay of courſe

202 By obſerving our own bent and character, &c.

Let the peculiar bent of our nature and character be obſerved, whether we are moſt inclined to form aſſociations and reliſh objects of the *ſenſible*, *intellectual*, or *moral* kind. Let that which has the aſcendant be particularly watched; let it be directed to right objects, be improved by proportioned exerciſes, and guarded by proper checks from an oppoſite quarter. Thus the *ſenſible* turn may be exalted by the *intellectual* and a taſte for the beauty of the *fine arts*, and both may be made ſubſervient to convey and rivet ſentiments highly *moral* and *public-ſpirited*. This inward ſurvey muſt extend to the *ſtrength* and *weakneſſes* of one's *nature*, one's *conditions*, *connections*, *habitudes*, *fortune*, *ſtudies*, *acquaintance*, and the other circumſtances of one's life, from which every man will form the juſteſt eſtimate of his own diſpoſitions and character, and the beſt rules for correcting and improving them. And in order to do this with more advantage, let thoſe *times* or *critical ſeaſons* be watched when the mind is beſt diſpoſed towards a change; and let them be improved by rigorous *reſolutions*, *promiſes*, or whatever elſe will engage the mind to perſevere in virtue. Let the *conduct*, in fine, be often reviewed, and the *cauſes* of its *corruption* or *improvement* be carefully obſerved.

203 By frequent moral exerciſes.

It will greatly conduce to refine the *moral taſte*, and ſtrengthen the *virtuous temper*, to accuſtom the mind to the frequent exerciſe of *moral ſentiments* and *determinations*, by reading *hiſtory*, *poetry*, particularly of the *pictureſque* and *dramatic* kind, the ſtudy of the *fine arts*; by converſing with the moſt eminent for good ſenſe and virtue; but, above all, by frequent and repeated acts of *humanity*, *compaſſion*, *friendſhip*, *politeneſs*, and *hoſpitality*. It is exerciſe that gives health and ſtrength. He that reaſons moſt frequently becomes the wiſeſt, and moſt enjoys the pleaſures of wiſdom. He who is moſt often affected by objects of compaſſion in poetry, hiſtory, or real life, will have his ſoul moſt open to pity, and its delightful pains and duties. So he alſo who practiſes moſt diligently the offices of kindneſs and charity, will by it cultivate that diſpoſition from whence all his pretenſions to perſonal merit muſt ariſe, his preſent and his future happineſs.

204 By an honeſt employment.

An uſeful and honourable employment in life will adminiſter a thouſand opportunities of this kind, and greatly ſtrengthen a ſenſe of virtue and good affections, which muſt be nouriſhed by right training, as well as our underſtandings. For ſuch an employment, by enlarging one's experience, giving an habit of attention and caution, or obliging one, from neceſſity or intereſt, to keep a guard over the paſſions, and ſtudy the outward decencies and appearances of virtue, will by degrees produce good habit, and at length inſinuate the love of virtue and honeſty for its own ſake.

205 By viewing men and manners in a fair light.

It is a great inducement to the exerciſe of benevolence to view *human nature* in a favourable light, to obſerve the characters and circumſtances of mankind on the *faireſt* ſides, to put the beſt conſtructions on their actions they will bear, and to conſider them as the reſult of *partial* and *miſtaken*, rather than *ill* affections, or, at worſt, as the exceſſes of a pardonable ſelf-love, ſeldom or never the effect of pure malice.

206 By conſideration and pious exerciſes.

Above all, the *nature* and *conſequences* of *virtue* and *vice*, their conſequences being the law of our nature and will of heaven; the light in which they appear to our ſupreme *Parent* and *Lawgiver*, and the reception they will meet with from him, muſt be often attended to. The exerciſes of *piety*, as *adoration*, and *praiſe* of the *divine* excellency, *invocation* of and *dependence* on his aid, *confeſſion*, *thankſgiving*, and *reſignation*, are habitually to be indulged, and frequently performed, not only as *medicinal*, but highly *improving* to the temper.

207 By juſt views of human life, and its connection with a future.

To conclude: it will be of admirable efficacy towards eradicating *bad* habits, and implanting *good* ones, frequently to contemplate *human life* as the great *nurſery* of our *future* and *immortal exiſtence*, as that *ſtate* of *probation* in which we are to be *educated* for a *divine life*; to remember, that our *virtues* or *vices* will be *immortal* as ourſelves, and influence our *future* as well as our *preſent* happineſs,—and therefore, that every diſpoſition and action is to be regarded as pointing beyond the *preſent* to an *immortal* duration.— An habitual attention to this wide and important *connection* will give a vaſt compaſs and dignity to our ſentiments and actions, a noble ſuperiority to the pleaſures and pains of life, and a generous ambition to make our *virtue* as *immortal* as our *being*.

CHAP. II. *Motives to* VIRTUE *from Perſonal* HAPPINESS.

208 Motives from perſonal happineſs.

We have already conſidered our *obligations* to the practice of *virtue*, ariſing from the *conſtitution* of our nature, by which we are led to *approve* a certain *order* and *œconomy* of *affections*, and a certain *courſe of action* correſpondent to it †. But, beſides this, there are ſeveral motives which ſtrengthen and ſecure virtue, though not themſelves of a *moral* kind. Theſe are, its *tendency to perſonal happineſs*, and the *contrary tendency of vice*. "Perſonal happineſs ariſes either from the ſtate of a man's own mind, or from the ſtate and diſpoſition of external cauſes towards him."

† *Vide* Part I. chap. i. ii. &c.

209 Happineſs of virtue from within.

We ſhall firſt examine the "tendency of virtue to happineſs with reſpect to the ſtate of a man's own mind." This is a point of the utmoſt conſequence in morals, becauſe, unleſs we can convince ourſelves, or ſhow to others, that, by doing our *duty*, or fulfilling our *moral obligations*, we conſult the greateſt ſatisfaction of our own mind, or our higheſt intereſt on the whole, it will raiſe ſtrong and often unſurmountable prejudices againſt the practice of virtue, eſpecially whenever there ariſes any appearances of *oppoſition* between our *duty* and our *ſatisfaction* or *intereſt*. To creatures ſo deſirous of happineſs, and averſe to miſery, as we are, and often ſo oddly ſituated amidſt contending paſſions and intereſts, it is neceſſary that virtue appear not only an *honourable* but a *pleaſing* and *beneficent* form. And in order to juſtify our choice to ourſelves as well as before others, we muſt ourſelves feel and be able to avow in the face of the whole world, that her ways are ways of pleaſantneſs, and her paths the paths of peace. This will ſhow, beyond all contradiction,

Motives to Virtue. tradiction, that we not only approve, but can give a sufficient reason for what we do.

210 Influence of vice on the temper of the mind.
Let any man in a cool hour, when he is disengaged from business, and undisturbed by passion (as such cool hours will sometimes happen), sit down, and seriously reflect with himself what state or temper of mind he would choose to feel and indulge, in order to be easy and to enjoy himself. Would he choose, for that purpose, to be in a constant dissipation and hurry of thought; to be disturbed in the exercise of his reason; to have various and often interfering phantoms of good playing before his imagination, soliciting and distracting him by turns, now soothing him with amusing hopes, then torturing him with anxious fears; and to approve this minute what he shall condemn the next? Would he choose to have a strong and painful sense of every petty injury; quick apprehensions of every impending evil; incessant and insatiable desires of power, wealth, honour, pleasure; an irreconcileable antipathy against all competitors and rivals; insolent and tyrannical dispositions to all below him; fawning, and at the same time envious, dispositions to all above him; with dark suspicions and jealousies of every mortal? Would he choose neither to love nor be beloved of any; to have no friend in whom to confide, or with whom to interchange his sentiments or designs; no favourite, on whom to bestow his kindness, or vent his passions; in fine, to be conscious of no merit with mankind, no esteem from any creature, no good affection to his Maker, no concern for, nor hopes of, his approbation; but, instead of all these, to hate, and know that he is hated, to condemn, and know that he is condemned by all; by the good, because he is so unlike; and by the bad, because he is so like themselves; to hate or to dread the very Being that made him; and, in short, to have his breast the seat of pride and passion, petulance and revenge, deep melancholy, cool malignity, and all the other furies that ever possessed and tortured mankind?—Would our calm inquirer after happiness pitch on such a state, and such a temper of mind, as the most likely means to put him in possession of his desired ease and self-enjoyment?

211 Influence of virtue on the temper.
Or would he rather choose a serene and easy flow of thought; a reason clear and composed; a judgment unbiassed by prejudice, and undistracted by passion; a sober and well-governed fancy, which presents the images of things true, and unmixed with delusive and unnatural charms, and therefore administers no improper or dangerous fuel to the passions, but leaves the mind free to choose or reject, as becomes a reasonable creature; a sweet and sedate temper, not easily ruffled by hopes or fears, prone neither to suspicion nor revenge, apt to view men and things in the fairest lights, and to bend gently to the humours of others rather than obstinately to contend with them? Would he choose such moderation and continence of mind, as neither to be ambitious of *power*, fond of *honours*, covetous of *wealth*, nor a slave to *pleasure*; a mind of course neither elated with success, nor dejected with disappointment; such a modest and noble spirit as supports power without insolence, wears honour without pride, uses wealth without profusion or parsimony; and rejoices more in giving than in receiving pleasure; such fortitude and equanimity as rises above misfortunes, or turns them into blessings; such integrity and greatness of mind, as neither flatters the vices, nor triumphs over the follies of men; as equally spurns servitude and tyranny, and will neither engage in low designs, nor abet them in others? Would he choose, in fine, such mildness and benignity of heart as takes part in all the joys, and refuses none of the sorrows, of others; stands well affected to all mankind; is conscious of meriting the esteem of all, and of being beloved by the best; a mind which delights in doing good without any shew, and yet arrogates nothing on that account; rejoices in loving and being beloved by its Maker, acts ever under his eye, resigns itself to his providence, and triumphs in his approbation?—Which of these dispositions would be his choice, in order to be contented, serene, and happy?—The *former* temper is VICE, the *latter* VIRTUE. Where *one* prevails, there MISERY prevails, and by the generality is acknoledged to prevail. Where the *other* reigns, there HAPPINESS reigns, and by the confession of mankind is acknowledged to reign. The *perfection* of either temper is *misery* or *happiness in perfection*.—THEREFORE, every *approach* to *either extreme* is an *approach* to *misery* or to *happiness*; *i. e.* every *degree* of *vice* or *virtue* is accompanied with a *proportionable degree* of *misery* or *happiness*. From Happiness.

The principal alleviations of a virtuous man's calamities are these:—That though some of them may have been the effect of his imprudence or weakness, yet few of them are sharpened by a sense of guilt, and none of them by a consciousness of wickedness, which surely is their keenest sting;—that they are common to him with the best of men;—that they seldom or never attack him quite unprepared, but rather guarded with a consciousness of his own sincerity and virtue, with a faith and trust in providence, and a firm resignation to its perfect orders;—that they may be improved as means of correction, or materials to give scope and stability to his virtues;—and, to name no more, they are considerably lessened, and often sweetened to him, by the general sympathy of the wise and good. 212 The alleviations of his ills.

His enjoyments are more numerous, or, if less numerous, yet more intense than those of the bad man; for he shares in the joys of others by rebound; and every increase of *general* or *particular* happiness is a real addition to his own. It is true, his friendly *sympathy* with others subjects him to some pains which the hard-hearted wretch does not feel; yet to give a loose to it, is a kind of agreeable discharge. It is such a sorrow as he loves to indulge; a sort of pleasing anguish that sweetly melts the mind, and terminates in a self-approving joy. Though the good man may want means to execute, or be disappointed in the success of, his benevolent purposes; yet, as was formerly* observed, he is still conscious of good affection, and that consciousness is an enjoyment of a more delightful savour than the greatest triumphs of successful vice. If the *ambitious*, *covetous*, or *voluptuous*, are disappointed, their passions recoil upon them with a fury proportioned to their opinion of the value of what they pursue, and their hope of success; while they have nothing within to balance the disappointment, unless it is an useless fund of pride, which, however, *frequently* turns mere accidents into mortifying affronts, and exalts grief into rage and frenzy. Whereas the meek, humble, 213 His enjoyments.

* See Part II. chap. ii.

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humble, and benevolent temper, is its own reward, is ſatisfied from within; and, as it magnifies greatly the pleaſure of ſucceſs, ſo it wonderfully alleviates, and in a manner annihilates, all pain for the want of it.

214 From merited eſteem and ſympathy.

As the good man is conſcious of loving and wiſhing well to all mankind, he muſt be ſenſible of his deſerving the eſteem and good-will of all; and this ſuppoſed reciprocation of ſocial feelings is, by the very frame of our nature, made a ſource of very intenſe and enlivening joys. By this ſympathy of affections and intereſts, he feels himſelf intimately united with the human race; and, being ſenſibly *alive* over the whole ſyſtem, his heart receives and becomes reſponſive to every touch given to any part. So that, as an eminent *philoſopher* § finely expreſſes it, he gathers contentment and delight from the pleaſed and happy ſtates of thoſe around him, from accounts and relations of ſuch happineſs, from the very countenances, geſtures, voices, and ſounds, even of creatures foreign to our kind, whoſe ſigns of joy and contentment he can any way diſcern.

§ *Vide* Shaftſb. *Inq. into Virtue*, Book II.

215 Do not interfere with other joys.

Nor do thoſe generous affections ſtop any other natural ſource of joy whatever, or deaden his ſenſe of any innocent gratification. They rather keep the ſeveral *ſenſes* and *powers of enjoyment* open and diſengaged, intenſe and uncorrupted by riot or abuſe; as is evident to any one who conſiders the diſſipated, unfeeling ſtate of men of *pleaſure, ambition*, or *intereſt*, and compares it with the ſerene and gentle ſtate of a mind at peace with itſelf, and friendly to all mankind, unruffled by any violent emotion, and ſenſible to every good-natured and alluring joy.

216 The miſery of exceſs in the private paſſions.

It were eaſy, by going through the different ſets of affections mentioned formerly *, to ſhow, that it is only by maintaining the proportion ſettled there, that the mind arrives at true repoſe and ſatisfaction. If *fear* exceeds that proportion, it ſinks into melancholy and dejection. If *anger* paſſes juſt bounds, it ferments into rage and revenge, or ſubſides into a ſullen corroding gloom, which embitters every good, and renders one exquiſitely ſenſible to every ill. The *private* paſſions, the *love of honour* eſpecially, whoſe impulſes are more generous, as its effects are more diffuſive, are inſtruments of private pleaſure; but if they are diſproportioned to our *wants*, or to the *value* of their ſeveral objects, or to the *balance* of other paſſions equally neceſſary and more amiable, they become inſtruments of intenſe pain and miſery. For, being now deſtitute of that counterpoiſe which held them at a due pitch, they grow turbulent, peeviſh, and revengeful, the cauſe of conſtant reſtleſſneſs and torment, ſometimes flying out into a wild delirious joy, at other times ſettling in a deep ſplenetic grief. The concert between reaſon and paſſion is then broke: all is diſſonance and diſtraction within. The mind is out of frame, and feels an agony proportioned to the violence of the reigning paſſion.

* *See* Part I. chap. i. ii.

217 In the public affections.

The caſe is much the ſame, or rather worſe, when any of the particular *kind* affections are out of their natural order and proportion; as happens in the caſe of *effeminate pity, exorbitant love, parental dottage*, or any *party-paſſion*, where the juſt regards to ſociety are ſupplanted. The more *ſocial* and *diſintereſted* the paſſion is, it breaks out into the wilder exceſſes, and makes the more dreadful havoc both within and abroad; as is but too apparent in thoſe caſes where a falſe ſpecies of *religion, honour, zeal*, or *party-rage*, has ſeized on the natural enthuſiaſm of the mind, and worked it up to madneſs. It breaks through all ties *natural* and *civil*, diſregards the moſt ſacred and ſolemn obligations, ſilences every other affection whether *public* or *private*, and transforms the moſt gentle natures into the moſt ſavage and inhuman.

From Happineſs.

218 Happineſs of well proportioned paſſions.

Whereas, the man who keeps the *balance* of *affection* even, is eaſy and ſerene in his motions; mild, and yet affectionate; uniform and conſiſtent with himſelf; is not liable to diſagreeable colliſions of intereſts and paſſions; gives always place to the moſt friendly and humane affections, and never to diſpoſitions or acts of reſentment, but on high occaſions, when the *ſecurity* of the *private*, or *welfare* of the *public* ſyſtem, or the *great intereſts* of mankind, neceſſarily require a noble indignation; and even then he obſerves a juſt meaſure in wrath: and laſt of all, he proportions every paſſion to the value of the object he affects, or to the importance of the end he purſues.

219 Sum of the argument.

To ſum up this part of the argument, the *honeſt* and *good* man has eminently the advantage of the *knaviſh* and *ſelfiſh* wretch in every reſpect. The pleaſures which the *laſt* enjoys flow chiefly from external advantages and gratifications; are ſuperficial and tranſitory; daſhed with long intervals of ſatiety, and frequent returns of remorſe and fear; dependent on favourable accidents and conjunctures; and ſubjected to the humours of men. But the *good* man is ſatisfied from himſelf; his principal poſſeſſions lie within, and therefore beyond the reach of the caprice of men or fortune; his enjoyments are exquiſite and permanent; accompanied with no inward checks to damp them, and always with ideas of dignity and ſelf-approbation; may be taſted at any time, and in any place. The gratifications of *vice* are turbulent and unnatural, generally ariſing from the relief of paſſions in themſelves intolerable, and iſſuing in tormenting reflection; often irritated by diſappointment, always inflamed by enjoyment, and yet ever cloyed with repetition. The pleaſures of *virtue* are calm and natural; flowing from the exerciſe of kind affections, or delightful reflections in conſequence of them; not only agreeable in the proſpect, but in the preſent feeling; they never ſatiate nor loſe their reliſh; nay, rather the admiration of virtue grows ſtronger every day; and not only is the deſire but the enjoyment heightened by every new gratification; and, unlike to moſt others, it is increaſed, not diminiſhed, by ſympathy and communication.—In fine, the ſatisfactions of *virtue* may be purchaſed without a bribe, and poſſeſſed in the humbleſt as well as the moſt triumphant fortune; they can bear the ſtricteſt review, do not change with circumſtances, nor grow old with time. Force cannot rob, nor fraud cheat us of them; and, to crown all, inſtead of abating, they enhance every other pleaſure.

220 External effects of virtue.

But the happy conſequences of *virtue* are ſeen not only in the internal enjoyments it affords a man, but "in the favourable diſpoſition of external cauſes towards him, to which it contributes."

221 On the body.

As *virtue* gives the ſober poſſeſſion of one's ſelf, and the command of one's paſſions, the conſequence muſt be heart's eaſe, and a fine natural flow of ſpirits, which conduce more than any thing elſe to health and long

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long life. Violent paſſions, and the exceſſes they occaſion, gradually impair and wear down the machine. But the calm placid ſtate of a temperate mind, and the healthful exerciſes in which *virtue* engages her faithful votaries, preſerve the natural functions in full vigour and harmony, and exhilarate the ſpirits, which are the chief inſtruments of action.

222 On one's fortune, intereſt, &c.

It may by ſome be thought odd to aſſert, that *virtue* is no enemy to a man's *fortune* in the preſent ſtate of things.—But if by *fortune* be meant a moderate or competent ſhare of *wealth*, *power*, or *credit*, not overgrown degrees of them; what ſhould hinder the virtuous man from obtaining that? He cannot cringe or fawn, it is true, but he can be civil and obliging as well as the knave; and ſurely his civility is more alluring, becauſe it has more manlineſs and grace in it than the mean adulation of the other: he cannot cheat or undermine; but he may be cautious, provident, watchful of occaſions, and equally prompt with the rogue in improving them: he ſcorns to proſtitute himſelf as a pander to the paſſions, or as a tool to the vices, of mankind; but he may have as ſound an underſtanding and as good capacities for promoting their real intereſts as the verieſt court-ſlave: and then he is more faithful and true to thoſe who employ him. In the common courſe of buſineſs, he has the ſame chances with the knave of acquiring a fortune, and riſing in the world. He may have equal abilities, equal induſtry, equal attention to buſineſs; and in other reſpects he has greatly the advantage of him. People love better to deal with him; they can truſt him more; they know he will not impoſe on them, nor take advantage of them, and can depend more on his word than on the oath or ſtrongeſt ſecurities of others. Whereas what is commonly called *cunning*, which is the *offspring of ignorance*, and conſtant *companion* of *knavery*, is not only a mean-ſpirited, but a very ſhort-ſighted talent, and a fundamental obſtacle in the road of buſineſs. It may procure indeed immediate and petty gains; but it is attended with dreadful abatements, which do more than overbalance them, both as it ſinks a man's credit when diſcovered, and cramps that largeneſs of mind which extends to the remoteſt as well as the neareſt intereſt, and takes in the moſt durable equally with the moſt tranſient gains. It is therefore eaſy to ſee how much a man's *credit* and *reputation*, and conſequently his ſucceſs, depend on his honeſty and virtue.

223 On one's peace and ſecurity.

With regard to *ſecurity* and *peace* with his neighbours, it may be thought, perhaps, that the man of a quiet forgiving temper, and a flowing benevolence and courteſy, is much expoſed to injury and affronts from every proud or peeviſh mortal, who has the power or will to do miſchief. If we ſuppoſe, indeed, this *quietneſs* and *gentleneſs* of nature accompanied with *cowardice* and *puſillanimity*, this may often be the caſe; but in reality the good man is bold as a lion, and ſo much the bolder for being the calmer. Such a perſon will hardly be a butt to mankind. The ill-natured will be afraid to provoke him, and the good-natured will not incline to do it. Beſides, *true virtue*, which is conducted by reaſon, and exerted gracefully and without parade, is a moſt inſinuating and commanding thing; if it cannot diſarm malice and reſentment at once, it will wear them out by degrees, and ſubdue them at length. How many have, by favours and prudently yielding, triumphed over an enemy, who would have been inflamed into tenfold rage by the fierceſt oppoſition! In fine, *goodneſs* is the moſt univerſally popular thing that can be.

From the Being and Providence of God.

224 On one's family.

To conclude; the good man may have ſome enemies, but he will have more friends; and, having given ſo many marks of private friendſhip or public virtue, he can hardly be deſtitute of a patron to protect, or a ſanctuary to entertain him, or to protect or entertain his children when he is gone. Though he ſhould have little elſe to leave them, he bequeaths them the faireſt, and generally the moſt unenvied, inheritance of a *good name*, which, like good ſeed ſown in the field of futurity, will often raiſe up unſolicited friends, and yield a benevolent harveſt of unexpected charities. But ſhould the fragrance of the parent's virtue prove offenſive to a perverſe or envious age, or even draw perſecution on the friendleſs orphans, there is *one* in heaven who will be more than a father to them, and recompenſe their parent's virtues by ſhowering down bleſſings on them.

CHAP. III. *Motives to* VIRTUE *from the* BEING *and* PROVIDENCE *of* GOD.

225 Two external motives to virtue.

BESIDES the intereſting motive mentioned in the laſt Chapter, there are two great motives to *virtue*, ſtrictly connected with *human life*, and reſulting from the very *conſtitution* of the *human mind*. The firſt is the BEING and PROVIDENCE of GOD; the ſecond is the IMMORTALITY of the SOUL, with *future rewards* and *puniſhments*.

226 Their importance.

It appears from Chap. iv. of Part II. that *man*, by the *conſtitution* of his nature, is deſigned to be a RELIGIOUS CREATURE. He is intimately connected with the *Deity*, and neceſſarily dependent on him. From that *connection* and neceſſary *dependence* reſult various *obligations* and *duties*, without fulfilling which, ſome of his ſublimeſt powers and affections would be incomplete and abortive. If he be likewiſe an IMMORTAL creature, and if his *preſent conduct* ſhall affect his *future happineſs* in *another* ſtate as well as in the *preſent*, it is evident that we take only a *partial view* of the *creature* if we leave out this important property of his nature, and make a *partial eſtimate of human life*; if we ſtrike out of the account, or overlook, that part of his duration which runs out into eternity.

227 Piety.

It is evident from the above-mentioned Chapter, that "to have a reſpect to the *Deity* in our temper and conduct, to *venerate* and *love* his *character*, to *adore* his *goodneſs*, to *depend upon* and *reſign* ourſelves to his *providence*, to *ſeek* his *approbation*, and *act* under a *ſenſe* of his *authority*, is a *fundamental part* of *moral virtue*, and the *completion* of the *higheſt deſtination* of *our nature*."

228 A ſupport to virtue.

But as *piety* is an eſſential part of virtue, ſo likewiſe it is a *great ſupport* and *enforcement* to the practice of it. To contemplate and admire a Being of ſuch tranſcendent dignity and perfection as GOD, muſt naturally and neceſſarily open and enlarge the mind, give a freedom and ampleneſs to its powers, and a grandeur and elevation to its aims. For, as an excellent *divine* obſerves, "the greatneſs of an object, and the excellency of the act of any AGENT about a tranſcendent object,

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object, doth mightily tend to the enlargement and improvement of his faculties." Little objects, mean company, mean cares, and mean buſineſs, cramp the mind, contract its views, and give it a creeping air and deportment. But when it ſoars above mortal cares and mortal purſuits into the regions of divinity, and converſes with the greateſt and beſt of Beings, it ſpreads itſelf into a wider compaſs, takes higher flights in reaſon and goodneſs, becomes godlike in its air and manners. *Virtue* is, if one may ſay ſo, both the *effect* and *cauſe* of largeneſs of mind. It requires that one think freely, and act nobly. Now what can conduce more to freedom of thought and dignity of action, than to conceive worthily of God, to reverence and adore his unrivalled excellency, to imitate and tranſcribe that excellency into our own nature, to remember our relation to him, and that we are the images and repreſentatives of his glory to the reſt of the creation? Such feelings and exerciſes muſt and will make us ſcorn all actions that are baſe, unhandſome, or unworthy our ſtate; and the relation we ſtand in to God will irradiate the mind with the light of wiſdom, and ennoble it with the liberty and dominion of virtue.

229 A guard and enforcement to virtue.

The influence and efficacy of *religion* may be conſidered in another light. We all know that the preſence of a friend, a neighbour, or any number of ſpectators, but eſpecially an auguſt aſſembly of them, uſes to be a conſiderable check upon the conduct of one who is not loſt to all ſenſe of honour and ſhame, and contributes to reſtrain many irregular ſallies of paſſion. In the ſame manner we may imagine, that the awe of ſome ſuperior mind, who is ſuppoſed privy to our ſecret conduct, and armed with full power to reward or puniſh it, will impoſe a reſtraint on us in ſuch actions as fall not under the controul or animadverſion of others. If we go ſtill higher, and ſuppoſe our inmoſt thoughts and darkeſt deſigns, as well as our moſt ſecret actions, to lie open to the notice of the ſupreme and univerſal mind, who is both the *ſpectator* and *judge* of human actions, it is evident that the belief of ſo auguſt a preſence, and ſuch awful inſpection, muſt carry a reſtraint and weight with it proportioned to the ſtrength of that belief, and be an additional motive to the practice of many duties which would not have been performed without it.

230 Exerciſes of piety improving to virtue.

It may be obſerved farther, that "to live under an habitual ſenſe of the *Deity* and his great *adminiſtration*, is to be converſant with *wiſdom*, *order*, and *beauty*, in the higheſt ſubjects, and to receive the delightful reflections and benign feelings which theſe excite while they irradiate upon him from every ſcene of nature and providence." How improving muſt ſuch views be to the mind, in dilating and exalting it above thoſe puny intereſts and competitions which agitate and inflame the bulk of mankind againſt each other!

Chap. IV. *Motive to* Virtue *from the* Immortality *of the* Soul, &c.

231 Metaphyſical arguments for its immortality.

The other motive mentioned was the *immortality* of the ſoul, with *future rewards* and *puniſhments*. The *metaphyſical* proofs of the ſoul's immortality are commonly drawn from—its *ſimple*, *uncompounded*, and *indiviſible* nature; from whence it is concluded, that it cannot be corrupted or extinguiſhed by a diſſolution or deſtruction of its parts:—from its having a *beginning* of *motion* within itſelf; whence it is inferred, that it cannot diſcontinue and loſe its motion:—from the different properties of *matter* and *mind*, the *ſluggiſhneſs* and *inactivity of one*, and the immenſe *activity* of the *other*; its prodigious flight of *thought* and *imagination*; its *penetration*, *memory*, *foreſight*, and *anticipations* of *futurity*: from whence it is concluded, that a being of ſo divine a nature cannot be extinguiſhed. But as theſe metaphyſical proofs depend on intricate reaſonings concerning the *nature*, *properties*, and *diſtinctions* of *body* and *mind*, with which we are not very well acquainted, they are not obvious to ordinary underſtandings, and are ſeldom ſo convincing even to thoſe of higher reach, as not to leave ſome doubts behind them. Therefore perhaps it is not ſo ſafe to reſt the proof of ſuch an important article on what many may call the ſubtilties of ſchool-learning. Thoſe proofs which are brought from *analogy*, from the *moral conſtitution* and *phænomena* of the *human mind*, the *moral attributes* of God, and the *preſent courſe of things*, and which therefore are called the *moral* arguments, are the plaineſt, and generally the moſt ſatisfying. We ſhall ſelect only one or two from the reſt.

From the Immortality of the Soul.

232 Moral proof from analogy.

In tracing the *nature* and *deſtination* of any being, we form the ſureſt judgment from his *powers* of *action*, and the ſcope and *limits* of theſe, compared with his *ſtate*, or with that *field* in which they are exerciſed. If this being paſſes through different ſtates, or fields of action, and we find a *ſucceſſion* of powers adapted to the different periods of his progreſs, we conclude that he was deſtined for thoſe ſucceſſive ſtates, and reckon his nature *progreſſive*. If, beſides the immediate ſet of powers which fit him for action in his preſent ſtate, we obſerve another ſet which appear ſuperfluous if he were to be confined to it, and which point to another or higher one, we naturally conclude, that he is not deſigned to remain in his preſent ſtate, but to advance to that for which thoſe ſupernumerary powers are adapted. Thus we argue, that the *inſect*, which has wings forming or formed, and all the apparatus proper for flight, is not deſtined always to creep on the ground, or to continue in the torpid ſtate of adhering to a wall, but is deſigned in its ſeaſon to take its flight in air. Without this farther deſtination, the admirable mechaniſm of wings and the other apparatus would be uſeleſs and abſurd. The ſame kind of reaſoning may be applied to man, while he lives only a ſort of *vegetative* life in the womb. He is furniſhed even there with a beautiful apparatus of organs, eyes, ears, and other delicate ſenſes, which receive nouriſhment indeed, but are in a manner folded up, and have no proper exerciſe or uſe in their preſent confinement*. Let us ſuppoſe ſome intelligent ſpectator, who never had any connection with man, nor the leaſt acquaintance with human affairs, to ſee this odd phenomenon, a creature formed after ſuch a manner, and placed in a ſituation apparently unſuitable to ſuch various machinery: muſt he not be ſtrangely puzzled about the uſe of his complicated ſtructure, and reckon ſuch a profuſion of art and admirable workmanſhip loſt on the ſubject; or reaſon by way of anticipation, that a creature endued with ſuch various yet unexerted capacities, was deſtined for a more enlarged ſphere

* *Vide* Ludov. Viv. *de Relig. Chriſt.* Lib. II. *de Vita Uteri*, &c.

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ſphere of action, in which thoſe latent capacities ſhall have full play? The vaſt variety and yet beautiful ſymmetry and proportions of the ſeveral parts and organs with which the creature is endued, and their apt coheſion with and dependence on the curious receptacle of their life and nouriſhment, would forbid his concluding the whole to be the birth of chance, or the bungling effort of an unſkilful artiſt; at leaſt would make him demur a while at ſo harſh a ſentence. But if, while he is in this ſtate of uncertainty, we ſuppoſe him to ſee the babe, after a few ſucceſsful ſtruggles, throwing off his fetters, breaking looſe from his little dark priſon, and emerging into open day, then unfolding his recluſe and dormant powers, breathing in air, gazing at light, admiring colours, ſounds, and all the *fair variety* of nature; immediately his doubts clear up, the propriety and excellency of the workmanſhip dawn upon him with full luſtre, and the whole myſtery of the firſt period is unravelled by the opening of this new ſcene. Though in this *ſecond* period the creature lives chiefly a kind of *animal*-life, i. e. of *ſenſe* and *appetite*, yet by various trials and obſervations he gains experience, and by the gradual evolution of the powers of *imagination* he ripens apace for an *higher* life, for exerciſing the arts of *deſign* and *imitation*, and of thoſe in which ſtrength or dexterity are more requiſite than acuteneſs or reach of judgment. In the ſucceeding *rational* or *intellectual* period, his *underſtanding*, which formerly crept in a lower, mounts into an higher ſphere, canvaſſes the natures, judges of the relations of things, forms ſchemes, deduces conſequences from what is paſt, and from preſent as well as paſt collects future events. By this ſucceſſion of ſtates, and of correſpondent culture, he grows up at length into a *moral*, a *ſocial*, and a *political* creature. This is the laſt period at which we perceive him to arrive in this his mortal career. Each *period* is introductory to the next ſucceeding one*; each *life* is a field of exerciſe and improvement for the next higher one; the life of the *fœtus* for that of the *infant*, the life of the *infant* for that of the *child*, and all the lower for the higheſt and beſt §.—But is this the laſt period of nature's progreſſion? Is this the utmoſt extent of her plot, where ſhe winds up the drama, and diſmiſſes the actor into eternal oblivion? Or does he appear to be inveſted with ſupernumerary powers, which have not full exerciſe and ſcope even in the laſt ſcene, and reach not that maturity or perfection of which they are capable; and therefore point to ſome higher ſcene where he is to ſuſtain another and more important character than he has yet ſuſtained? If any ſuch there are, may we not conclude by analogy, or in the ſame way of anticipation as before, that he is deſtined for that after-part, and is to be produced upon a more auguſt and ſolemn ſtage, where his ſublimer powers ſhall have proportioned action, and his nature attain its completion?

* See Butler's *Analogy*, Part I.

233 Powers in man which point to an after-life.

If we attend to that *curioſity*, or prodigious *thirſt* of *knowledge*, which is natural to the mind in every period of its progreſs, and conſider withal the endleſs round of buſineſs and care, and the various hardſhips to which the bulk of mankind are chained down; it is evident, that in this preſent ſtate it is impoſſible to expect the gratification of an appetite at once ſo inſatiable and ſo noble. Our *ſenſes*, the ordinary organs by which knowledge is let into the mind, are always imperfect, and often fallacious; the advantages of aſſiſting or correcting them are poſſeſſed by few; the difficulties of finding out truth amidſt the various and contradictory opinions, intereſts, and paſſions of mankind, are many; and the wants of the creature, and of thoſe with whom he is connected, numerous and urgent: ſo that it may be ſaid of moſt men, that their *intellectual* organs are as much ſhut up and ſecluded from proper nouriſhment and exerciſe in that little circle to which they are confined, as the bodily organs are in the womb. Nay, thoſe who to an aſpiring genius have added all the aſſiſtances of art, leiſure, and the moſt liberal education, what narrow proſpects can even they take of this unbounded ſcene of things from that little eminence on which they ſtand? and how eagerly do they ſtill graſp at new diſcoveries, without any ſatisfaction or limit to their ambition?

234 Intellectual.

From the immortality of the Soul.

235 Moral powers.

But ſhould it be ſaid, that man is made for *action*, and not for *ſpeculation*, or fruitleſs ſearches after knowledge, we aſk, For what kind of action? Is it only for bodily exerciſes, or for *moral*, *political*, and *religious* ones? Of all theſe he is capable; yet, by the unavoidable circumſtances of his lot, he is tied down to the *former*, and has hardly any leiſure to think of the *latter*, or, if he has, wants the proper inſtruments of exerting them. The *love of virtue*, *of one's friends* and *country*, the *generous ſympathy with mankind*, and *heroic zeal of doing good*, which are all ſo *natural* to great and good minds, and ſome traces of which are found in the loweſt, are ſeldom united with proportioned means or opportunities of exerciſing them: ſo that the *moral* ſpring, the noble energies and impulſes of the mind, can hardly find proper ſcope even in the moſt fortunate condition; but are much depreſſed in ſome, and almoſt entirely reſtrained in the generality, by the numerous clogs of an indigent, ſickly, or embaraſſed life. Were ſuch mighty powers, ſuch god-like affections, planted in the human breaſt to be folded up in the narrow womb of our preſent exiſtence, never to be produced into a more *perfect* life, nor to expatiate in the ample career of immortality?

236 Unſatisfied deſires of exiſtence and happineſs.

Let it be conſidered, at the ſame time, that no poſſeſſion, no enjoyment, within the round of mortal things, is commenſurate to the deſires, or adequate to the capacities, of the mind. The moſt exalted condition has its abatements; the happieſt conjuncture of fortune leaves many wiſhes behind; and, after the higheſt gratifications, the mind is carried forward in purſuit of new ones without end. Add to all, the fond *deſire* of *immortality*, the ſecret *dread* of *non-exiſtence*, and the high unremitting *pulſe* of the ſoul beating for *perfection*, joined to the improbability or the impoſſibility of attaining it *here*; and then judge whether this elaborate ſtructure, this magnificent apparatus of inward powers and organs, does not plainly point out an *hereafter, and intimate eternity to man?* Does nature give the finiſhing touches to the leſſer and ignobler inſtances of her ſkill, and raiſe every other creature to the maturity and perfection of his being; and ſhall ſhe leave her principal workmanſhip unfiniſhed? Does ſhe carry the *vegetative* and *animal* life in *man* to their full vigour and higheſt deſtination; and ſhall ſhe ſuffer his *intellectual*, his *moral*, his *divine* life,

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to fade away, and be for ever extinguiſhed? Would ſuch abortions in the *moral* world be congruous to that *perfection of wiſdom and goodneſs* which upholds and adorns the *natural?*

237 Therefore man immortal.

We muſt therefore conclude from this detail, that the *preſent ſtate*, even at its beſt, is only the WOMB of man's being, in which the nobleſt principles of his nature are in a manner fettered, or ſecluded from a correſpondent ſphere of action; and therefore deſtined for a future and unbounded ſtate, where they ſhall emancipate themſelves, and exert the fulneſs of their ſtrength. The moſt accompliſhed mortal, in this low and dark apartment of nature, is only the *rudiments* of what he ſhall be when he takes his ethereal flight, and puts on immortality. Without a reference to that ſtate, *man* were a mere abortion, a rude unfiniſhed embryo, a monſter in nature. But this being once ſuppoſed, he ſtill maintains his rank of the maſter-piece of the creation; his latent powers are all ſuitable to the *harmony* and *progreſſion* of nature; his noble aſpirations, and the pains of his diſſolution, are his efforts towards a *ſecond* birth, the pangs of his delivery into light, liberty, and perfection; and *death*, his diſcharge from gaol, his ſeparation from his fellow-priſoners, and introduction into the aſſembly of thoſe heroic ſpirits who are gone before him, and of their great eternal Parent. The fetters of his mortal coil being looſened, and his priſon walls broke down, he will be bare and open on every ſide to the admiſſion of *truth* and *virtue*, and their fair attendant *happineſs;* every *vital* and *intellectual* ſpring will evolve itſelf with a divine elaſticity in the free air of heaven. He will not then peep at the univerſe and its glorious Author through a dark grate or a groſs medium, nor receive the reflections of his glory through the ſtrait openings of ſenſible organs; but will be *all eye, all ear, all ethereal and divine feeling* *. Let one part, however, of the analogy be attended to: That as in the womb we receive our original conſtitution, form, and the eſſential *ſtamina* of our being, which we carry along with us into the light, and which greatly affect the ſucceeding periods of our life; ſo our temper and condition in the *future* life will depend on the conduct we have obſerved, and the character we have formed, in the *preſent* life. We are *here* in *miniature* what we ſhall be at *full length hereafter*. The firſt *rude ſketch* or *out-lines* of *reaſon* and *virtue* muſt be drawn at preſent, to be afterwards enlarged to the *ſtature* and *beauty* of angels.

* *Vide* Religion of Nature, § 9.

238 Immortality a guard and incentive to virtue.

This, if duly attended to, muſt prove not only a *guard*, but an admirable *incentive* to virtue. For he who faithfully and ardently follows the light of knowledge, and pants after higher improvements in virtue, will be wonderfully animated and inflamed in that purſuit by a full conviction that the ſcene does not cloſe with life—that his ſtruggles, ariſing from the weakneſs of nature and the ſtrength of habit, will be turned into triumphs—that his career in the tract of wiſdom and goodneſs will be both ſwifter and ſmoother—and thoſe generous ardours with which he glows towards *heaven*, i. e. the *perfection* and *immortality of virtue*, will find their adequate object and exerciſe in a ſphere proportionably enlarged, incorruptible, immortal. On the other hand, what an inexpreſſible damp muſt it be to the good man, to dread the total extinction of that *light* and *virtue*, without which *life*, nay, *immortality* itſelf, were not worth a ſingle wiſh?

From the Immortality of the Soul.

Many writers draw their proofs of the immortality of the ſoul, and of a future ſtate of rewards and puniſhments, from the unequal diſtribution of theſe here.

239 Proof from the inequality of preſent diſtributions.

It cannot be diſſembled that wicked men often eſcape the *outward* puniſhment due to their crimes, and do not feel the *inward* in that meaſure their demerit ſeems to require, partly from the callouſneſs induced upon their nature by the habits of vice, and partly from the diſſipation of their minds abroad by pleaſure or buſineſs—and ſometimes good men do not reap all the natural and genuine fruits of their virtue, through the many unforeſeen or unavoidable calamities in which they are involved. To the ſmalleſt reflection, however, it is obvious, that the natural tendency of virtue is to produce happineſs; that if it were univerſally practiſed, it would, in fact, produce the greateſt ſum of happineſs of which human nature is capable; and that this tendency is defeated only by numerous individuals, who, forſaking the laws of virtue, injure and oppreſs thoſe who ſteadily adhere to them. But the natural tendency of virtue is the reſult of that conſtitution of things which was eſtabliſhed by God at the creation of the world. This being the caſe, we muſt either conclude, that there will be a future ſtate, in which all the moral obliquities of the preſent ſhall be made ſtraight; or elſe admit, that the deſigns of infinite wiſdom, goodneſs, and power, can be finally defeated by the perverſe conduct of human weakneſs.—But this laſt ſuppoſition is ſo extravagantly abſurd, that the reality of a future ſtate, the only other poſſible alternative, may be pronounced to have the evidence of perfect demonſtration.

240 Belief of immortality, &c. a great ſupport amidſt trials.

Virtue has preſent rewards, and *vice* preſent puniſhments annexed to it; ſuch rewards and puniſhments as make *virtue*, in moſt caſes that happen, far more eligible than *vice:* but, in the infinite variety of human contingencies, it may ſometimes fall out, that the inflexible practice of virtue ſhall deprive a man of conſiderable advantages to himſelf, his family, or friends, which he might gain by a well-timed piece of roguery; ſuppoſe by betraying his truſt, voting againſt his conſcience, ſelling his country, or any other crime where the ſecurity againſt diſcovery ſhall heighten the temptation. Or, it may happen, that a ſtrict adherence to his honour, to his religion, to the cauſe of liberty and virtue, ſhall expoſe him, or his family, to the loſs of every thing, nay, to poverty, ſlavery, death itſelf, or to torments far more intolerable. Now what ſhall ſecure a man's virtue in circumſtances of ſuch trial? What ſhall enforce the obligations of conſcience againſt the allurements of ſo many intereſts, the dread of ſo many and ſo terrible evils, and the almoſt unſurmountable averſion of human nature to exceſſive pain! The conflict is the greater, when the circumſtances of the crime are ſuch as eaſily admit a variety of alleviations from *neceſſity, natural affection, love to one's family* or *friends*, perhaps in indigence: theſe will give it even the air of virtue. Add to all, that the crime may be thought to have few bad conſequences,—may be eaſily concealed,—or imagined poſſible to be retrieved in a good meaſure by future good conduct. It is obvious to which ſide moſt men will lean in ſuch a caſe; and how much need there is of a balance in the

Motives to Virtue

the opposite scale, from the consideration of a *God*, of a *Providence*, and of an *immortal state of retribution*, to keep the mind firm and uncorrupt in those or like instances of singular trial or distress.

241 In the general course of life.

But without supposing such peculiar instances, a sense of a governing Mind, and a persuasion that virtue is not only befriended by him here, but will be crowned by him hereafter with rewards suitable to its nature, vast in themselves, and immortal in their duration, must be not only a mighty support and incentive to the practice of virtue, but a strong barrier against vice. The thoughts of an Almighty Judge, and of an impartial future reckoning, are often alarming, inexpressibly so, even to the stoutest offenders. On the other hand, how supporting must it be to the good man, to think that he acts under the eye of his friend, as well as judge! How improving, to consider the *present state* as connected with a *future* one, and every relation in which he stands as a *school* of *discipline* for his *affections*; every *trial* as the *exercise* of some *virtue*; and the virtuous deeds which result from both, as introductory to higher scenes of *action* and *enjoyment*! Finally, how transporting is it to view *death* as his *discharge* from the *warfare* of *mortality*, and a triumphant *entry* into a state of freedom, security, and perfection, in which knowledge and wisdom shall break upon him from every quarter; where each faculty shall have its proper object; and his virtue, which was often damped or defeated here, shall be enthroned in undisturbed and eternal empire!

On reviewing this short *system* of *morals*, and the *motives* which support and enforce it, and comparing both with the CHRISTIAN *scheme*, what *light* and *vigour* do they borrow from thence! How clearly and fully does CHRISTIANITY lay open the *connections* of our nature, both *material* and *immaterial*, and *future* as well *present*! What an ample and beautiful detail does it present of the *duties* we owe to *God*, to *society*, and *ourselves*, promulgated in the most simple, intelligible, and popular manner; divested of every partiality of sect or nation; and adapted to the general state of mankind! With what bright and alluring *examples* does it illustrate and recommend the practice of those duties; and with what mighty *sanctions* does it enforce that practice! How strongly does it describe the *corruptions* of our nature; the *deviations* of our life from the *rule* of *duty*, and the *causes* of both! How marvellous and benevolent a plan of *redemption* does it unfold, by which those corruptions may be remedied, and our *nature* restored from its *deviations* to transcendent heights of *virtue* and *piety*! Finally, what a fair and comprehensive prospect does it give us of the *administration* of *God*, of which it represents the *present state* only as a *small period*, and a *period* of *warfare* and *trial*! How solemn and unbounded are the scenes which it opens beyond it! the *resurrection* of the *dead*, the *general judgment*, the *equal distribution* of *rewards* and *punishments* to the *good* and the *bad*; and the full *completion* of *divine wisdom* and *goodness* in the *final establishment* of *order*, *perfection*, and *happiness*! How glorious then is that SCHEME of RELIGION, and how worthy of *affection* as well as of *admiration*, which, by making such *discoveries*, and affording such *assistances*, has disclosed the unfading fruits and triumphs of VIRTUE, and secured its interests beyond the power of TIME and CHANCE.

From the Immortality of the Soul.

241 Advantages of the Christian scheme, and its connection with natural religion or morality.

MORAL Sense, that whereby we perceive what is good, virtuous, and beautiful, in actions, manners, and characters. See *MORAL Philosophy*.

MORALITY. See *MORAL Philosophy*.

MORANT (Philip), a learned and indefatigable antiquary and biographer, son of Stephen Morant, was born at St Saviour's in the isle of Jersey, October 6. 1700; and, after finishing his education at Abingdon school, was entered December 16th, 1717 at Pembroke college Oxford, where he took the degree of B. A. June 10th, 1721, and continued till midsummer 1722; when he was preferred to the office of preacher of the English church at Amsterdam, but never went to take possession. He took the degree of M. A. in 1724, and was presented to the rectory of Shellow Bowells, April 20th 1733; to the vicarage of Bromfield, January 17th 1733-4; to the rectory of Chicknal Smeley, September 19th, 1735; to that of St Mary's, Colchester, March 9th, 1737; to that of Wickham Bishop's, January 21st, 1742-3; and to that of Aldham, September 14th, 1745. All these benefices are in the county of Essex. In 1748 he published his History of Colchester, of which only 200 copies were printed. In 1751 he was elected F. S. A.; and in February 1768 he was appointed by the lords sub-committees of the house of peers to succeed Mr Blyke in preparing for the press a copy of the rolls of parliament; a service to which he diligently attended till his death, which happened November 25th, 1770. Besides the above work, and many useful translations, abridgements, and compilations, &c. he wrote, all the Lives in the *Biographia Britannica* marked C; also the life of Stillingfleet, which has no mark at the end: The History of Essex, 1760, 1768, 2 vols folio: The life of King Edward the Confessor, and about 150 sermons. He prepared the rolls of parliament as far as the 16th of Henry IV. The continuation of the task devolved upon Thomas Astle, Esq; who had married his only daughter.

MORANT-Point, the most easterly point or promontory of the island of Jamaica, in America. W. Lon. 75. 56. N. Lat. 17. 56.

MORASS, a marsh, fen, or low moist ground, which receives the waters from above without having any descent to carry them off again. Somner derives the word from the Saxon *merse*, "lake;" Salmasius from *mare*, "a collection of waters;" others from the Geman *marast*, "a muddy place;" and others from *maresc*, of *maricetum*, *à mariscis*, i. e. rushes. See BOG, FEN, and DRAINING.

In Scotland, Ireland, and the north of England, they have a peculiar kind of morasses called *mosses* or *peat-mosses*, whence the country people dig their peat or turf for firing. See MOSS.

MORAT, or MURTEN, a rich trading, and considerable-

Morat, Morata.

fiderable town of Swifferland, capital of a bailiwick of the fame name, belonging to the cantons of Bern and Friberg, with a caftle, where the bailiff refides. It is feated on the lake Morat, on the road from Avenche to Bern, 10 miles weft of Bern and 10 miles north-eaft of Friburg. The lake is about fix miles long and two broad, the country about it being pleafant and well cultivated. The lakes of Morat and Neufchatel are parallel to each other, but the latter is more elevated, difcharging itfelf by means of the river Broye into the lake of Neufchatel. According to M. de Luc, the former is 15 French feet above the level of Neufchatel lake; and both thefe lakes, as well as that of Bienne, feem formerly to have extended confiderably beyond their prefent limits, and from the pofition of the country appear to have been once united. Formerly the large fifh named *filurus glanis*, or the faluth, frequented thefe lakes, but has not been caught in them for a long time paft. The environs of this town and lake were carefully examined by Mr Coxe during his refidence in Switzerland, who made feveral excurfions acrofs the lake to a ridge of hills fituated betwixt it and Neufchatel. Here are many delightful profpects; particularly one from the top of mount Vuilly, which, he fays, is perhaps the only central fpot from which the eye can at once comprehend the vaft ampitheatre formed on one fide by the Jura ftretching from the environs of Geneva as far as Bafle, and, on the other, by that ftupendous chain of fnowy Alps which extend from the frontiers of Italy to the confines of Germany, and is loft at each extremity in the horizon. Morat is celebrated for the obftinate defence it made againft Charles the Bold, duke of Burgundy, and for the battle which afterwards followed on the 22d of June 1476, where the duke was defeated, and his army almoft entirely deftroyed*. Not far from the town, and adjoining to the high-road, there ftill remains a monument of this victory. It is a fquare building, filled with the bones of Burgundian foldiers, who were flain at the fiege and in the battle; the number of which appears to have been very confiderable. There are feveral infcriptions in the Latin and German languages commemorating the victory.

* See *Hiftory of France*.

MORATA (Olympia Fulvia), an Italian lady, diftinguifhed for her learning, was born at Ferrara, in 1526. Her father, after teaching the belles lettres in feveral cities of Italy, was made preceptor to the two young princes of Ferrara, the fons of Alphonfus I. The uncommon abilities he difcovered in his daughter determined him to give her a very extraordinary education. Meanwhile the princefs of Ferrara ftudying polite literature, it was judged expedient that fhe fhould have a companion in the fame purfuit; and Morata being called, fhe was heard by the aftonifhed courtiers to declaim in Latin, to fpeak Greek, and to explain the paradoxes of Cicero. Her father dying, fhe was obliged to return home to take upon her the management of family-affairs, and the education of her brother and three fifters; both which fhe executed with the greateft diligence and fuccefs. In the mean time Andrew Grunthler, a young German, who had ftudied phyfic, and taken his doctor's degree at Ferrara, fell in love with her, and married her. She now went with her hufband to Germany, taking her little brother with her, whom fhe inftructed in the Latin and Greek tongues; and after ftaying a fhort time at Augfburg, went to Schweinfort in Franconia, where her hufband was born; but they had not been there long before that town was unhappily befieged and burnt; however, efcaping the flames, they fled in the utmoft diftrefs to Hammelburg. This place they were alfo obliged to quit, and were reduced to the laft extremities, when the elector palatine invited Grunthler to be profeffor of phyfic at Heidelberg, and he entered on his new office in 1554; but they no fooner began to tafte the fweets of repofe, than a difeafe, occafioned by the diftreffes and hardfhips they had fuffered, feized upon Morata, who died in 1555, in the 29th year of her age; and her hufband and brother did not long furvive her. She compofed feveral works, great part of which were burnt with the town of Schweinfort; the remainder, which confift of orations, dialogues, letters, and tranflations, were collected and publifhed under the title of *Olympiæ Fulviæ Moratæ, fœminæ doctiffimæ, et plane divinæ, opera omnia quæ hactenus inveniri potuerint; quibus Cœlii fecundi curionis epiftola ac orationes acceffferunt;* which has had feveral editions in octavo.

Moravia.

MORAVIA, a river of Turky in Europe, which rifes in Bulgaria, runs north through Servia by Niffa, and falls into the Danube at Semendria, to the eaftward of Belgrade.

MORAVIA, a marquifate of Germany, derives the name of *Mahern*, as it is called by the Germans, and of *Morawa*, as it is called by the natives, from the river of that name which rifes in the mountains of the county of Glatz, and paffes through the middle of it. It is bounded to the fouth by Auftria, to the north by Glatz and Silefia, to the weft by Bohemia, and to the eaft by Silefia and Hungary; being about 120 miles in length and 100 in breadth.

A great part of this country is over-run with woods and mountains, where the air is very cold, but much wholefomer than in the low grounds, which are full of bogs and lakes. The mountains, in general, are barren; but the more champaign parts tolerably fertile, yielding corn, with plenty of hemp and flax, good faffron, and pafture. Nor is it altogether deftitute of wine, red and white, fruits, and garden-ftuff. Moravia alfo abounds in horfes, black cattle, fheep, and goats. In the woods and about the lakes there is plenty of wild fowl, game, venifon, bees, honey, hares, foxes, wolves, beavers, &c. In this country are likewife quarries of marble, baftard diamonds, amethyfts, alum, iron, fulphur, falt-petre, and vitriol, with wholefome mineral-waters, and warm fprings; but falt is imported. Its rivers, of which the March, Morawa, or Morau, are the chief, abound with trout, crayfifh, barbels, eels, perch, and many other forts of fifh.

The language of the inhabitants is a dialect of the Sclavonic, differing little from the Bohemian; but the nobility and citizens fpeak German and French.

Moravia was anciently inhabited by the Quadi, who were driven out by the Sclavi. Its kings, who were once powerful and independent, afterwards became dependent on, and tributary to, the German emperors and kings. At laft, in the year 908, the Moravian kingdom was parcelled out among the Germans, Poles, and

and Hungarians. In 1086, that part of it properly called *Moravia* was declared a marquisate by the German king Henry IV. and united with Bohemia, to whose dukes and kings it hath ever since been subject. Though it is not very populous, it contains about 42 greater or walled towns, 17 smaller or open towns, and 198 market-towns, besides villages, &c. The states of the country consist of the clergy, lords, knights, and burgesses; and the diets, when summoned by the regency, are held at Brunn. The marquisate is still governed by its own peculiar constitutions, under the *directorium in publicis & cameralibus*, and the supreme judicatory at Vienna. It is divided into six circles, each of which has its captain, and contributes to its sovereign about one-third of what is exacted of Bohemia. Towards the expences of the military establishment of the whole Austrian hereditary countries, its yearly quota is 1,856,490 florins. Seven regiments of foot, one of cuirassiers, and one of dragoons, are usually quartered in it.

Christianity was planted in this country in the 9th century; and the inhabitants continued attached to the church of Rome till the 15th, when they espoused the doctrine of John Huss, and threw off Popery: but after the defeat of the elector Palatine, whom they had chosen king, as well as the Bohemians, the emperor Ferdinand II. re-established popery; though there are still some Protestants in Moravia. The bishop of Olmutz, who stands immediately under the pope, is at the head of the ecclesiastics in this country. The supreme ecclesiastical jurisdiction, under the bishop, is vested in a consistory.

The commerce of this country is inconsiderable. Of what they have, Brunn enjoys the principal part. At Iglau and Trebitx are manufactures of cloth, paper, gun-powder, &c. There are also some iron-works and glass-houses in the country.

The inhabitants of Moravia in general are open-hearted, not easy to be provoked or pacified, obedient to their masters, and true to their promises; but credulous of old prophecies, and much addicted to drinking, though neither such sots or bigots as they are represented by some geographers. The boors, indeed, upon the river Hank, are said to be a thievish, unpolished, brutal race. The sciences now begin to lift up their heads a little among the Moravians, the university of Olmutz having been put on a better footing; and a riding academy, with a learned society, have been lately established there.

MORAVIAN BRETHREN. See HERNHUTTERS, and UNITAS *Fratrum*.

MORAW, or MORAVA, a large river of Germany, which has its source on the confines of Bohemia and Silesia. It crosses all Moravia, where it waters Olmutz and Hradisch, and receiving the Taya from the confines of Lower Hungary and Upper Austria, separates these two countries as far as the Danube, into which it falls.

MORBID, among physicians, signifies "diseased or corrupt;" a term applied either to an unsound constitution, or to those parts or humours that are affected by a disease.

MORBUS COMITIALIS, a name given to the epilepsy; because if on any day when the people were assembled in *comitia* upon public business, any person suddenly seized with this disorder should fall down, the assembly was dissolved, and the business of the *comitia*, however important, was suspended. See COMITIA.

MORBUS Regius, the same with the JAUNDICE. See MEDICINE *Index*.

MORBUS, or *Disease*, in botany. See VARIETAS.

MORDAUNT (Charles), earl of Peterborough, a celebrated commander both by sea and land, was the son of John Lord Mordaunt viscount Avalon, and was born about the year 1658. In 1675 he succeeded his father in his honours and estate. While young he served under the admirals Torrington and Narborough in the Mediterranean against the Algerines; and in 1680 embarked for Africa with the earl of Plymouth, and distinguished himself at Tangier when it was besieged by the Moors. In the reign of James II. he voted against the repeal of the test act; and disliking the measures of the court, obtained leave to go to Holland to accept the command of a Dutch squadron in the West Indies. He afterwards accompanied the prince of Orange into this kingdom; and upon his advancement to the throne, was sworn of the privy-council, made one of the lords of the bedchamber to his majesty, also first commissioner of the treasury, and advanced to the dignity of earl of Monmouth. But in November 1690 he was dismissed from his post in the treasury. On the death of his uncle Henry earl of Peterborough in 1697, he succeeded to that title; and, upon the accession of Queen Anne, was invested with the commission of captain-general and governor of Jamaica. In 1705 he was sworn of the privy-council; and the same year declared general and commander in chief of the forces sent to Spain, and joint admiral of the fleet with Sir Cloudsley Shovel, of which the year following he had the sole command. His taking Barcelona with a handful of men, and afterwards relieving it when greatly distressed by the enemy; his driving out of Spain the duke of Anjou, and the French army, which consisted of 25,000 men, though his own troops never amounted to 10,000; his gaining possession of Catalonia, of the kingdoms of Valencia, Arragon, and the isle of Majorca, with part of Murcia and Castile, and thereby giving the earl of Galway an opportunity of advancing to Madrid without a blow; are astonishing instances of his bravery and conduct. For these important services his Lordship was declared general in Spain by Charles III. afterwards emperor of Germany; and on his return to England he received the thanks of the House of Lords. His Lordship was afterwards employed in several embassies to foreign courts, installed knight of the garter, and made governor of Minorca. In the reign of George I. he was general of all the marine forces in Great Britain, in which post he was continued by King George II. He died in his passage to Lisbon, where he was going for the recovery of his health, in 1735.—His Lordship was distinguished by his possessing various shining qualities: for, to the greatest personal courage and resolution, he added all the arts and address of a general; a lively and penetrating genius; and a great extent of knowledge upon almost every subject of importance within the compass of

of ancient and modern literature; hence his familiar letters, inserted among those of his friend Mr Pope, are an ornament to that excellent collection.

Plate CCCXV.

MORDELLA, in zoology, a genus of insects of the coleoptera order. The antennæ are thread-shaped and serrated; the head is deflected under the neck; the pappi are clavated, compressed, and obliquely blunted; and the elytra are bent backwards near the apex. There are six species, all natives of different parts of Europe.

MORE (Sir Thomas), lord high chancellor of England, the son of Sir John More, knight, one of the judges of the King's-bench, was born in the year 1480, in Milk-street, London. He was first sent to a school at St Anthony's in Threadneedle street; and afterwards introduced into the family of cardinal Moreton, who in 1497 sent him to Canterbury college in Oxford. During his residence at the university he constantly attended the lectures of Linacre and Grocinus, on the Greek and Latin languages. Having in the space of about two years made considerable proficiency in academical learning, he came to New-inn in London, in order to study the law; whence, after some time, he removed to Lincoln's-inn, of which his father was a member. Notwithstanding his application to the law, however, being now about 20 years old, he was so bigotted to monkish discipline, that he wore a hair-shirt next his skin, frequently fasted, and often slept on a bare plank. In the year 1503, being then a burgess in parliament, he distinguished himself in the house, in opposition to the motion for granting a subsidy and three fifteenths for the marriage of Henry VII.'s eldest daughter, Margaret, to the king of Scotland. The motion was rejected; and the king was so highly offended at this opposition from a beardless boy, that he revenged himself on Mr More's father, by sending him on a frivolous pretence to the Tower, and obliging him to pay 100 l. for his liberty. Being now called to the bar, he was appointed law-reader at Furnival's inn, which place he held about three years; but about this time he also read a public lecture in the church of St Lawrence, Old Jewry, upon St Austin's treatise *De civitate Dei*, with great applause. He had indeed formed a design of becoming a Franciscan friar, but was dissuaded from it; and, by the advice of Dr Colet, married Jane, the eldest daughter of John Colt, Esq; of Newhall in Essex. In 1508 he was appointed judge of the sheriff's court in the city of London, was made a justice of the peace, and became very eminent at the bar. In 1516 he went to Flanders in the retinue of Bishop Tonstal and Dr Knight, who were sent by King Henry VIII. to renew the alliance with the archduke of Austria, afterwards Charles V. On his return, Cardinal Wolsey would have engaged Mr More in the service of the crown, and offered him a pension, which he refused. Nevertheless, it was not long before he accepted the place of master of the requests, was created a knight, admitted of the privy-council, and in 1520 made treasurer of the exchequer. About this time he built a house on the bank of the Thames, at Chelsea, and married a second wife. This wife whose name was *Middleton*, and a widow, was old, ill-tempered, and covetous; nevertheless Erasmus says he was as fond of her as if she were a young maid.

In the 14th year of Henry VIII. Sir Thomas More was made speaker of the house of commons: in which capacity he had the resolution to oppose the then powerful minister, Wolsey, in his demand of an oppressive subsidy; notwithstanding which, it was not long before he was made chancellor of the duchy of Lancaster, and was treated by the king with singular familiarity. The king having once dined with Sir Thomas at Chelsea, walked with him near an hour in the garden, with his arm round his neck. After he was gone, Mr Roper, Sir Thomas's son-in-law, observed how happy he was to be so familiarly treated by the king: to which Sir Thomas replied, "I thank our lord, son Roper, I find his grace my very good lord indeed, and believe he doth as singularly favour me as any subject within this realm: howbeit, I must tell thee, I have no cause to be proud thereof; for if my head would win him a castle in France, it would not fail to go off." From this anecdote it appears, that Sir Thomas knew his grace to be a villain.

In 1526 he was sent, with Cardinal Wolsey and others, on a joint embassy to France, and in 1529 with Bishop Tonstal to Cambray. The king, it seems, was so well satisfied with his services on these occasions, that in the following year, Wolsey being disgraced, he made him chancellor; which seems the more extraordinary, when we are told that Sir Thomas had repeatedly declared his disapprobation of the king's divorce, on which the great *defensor fidei* was so positively bent. Having executed the office of chancellor about three years, with equal wisdom and integrity, he resigned the seals in 1533, probably to avoid the danger of his refusing to confirm the king's divorce. He now retired to his house at Chelsea; dismissed many of his servants; sent his children with their respective families to their own houses (for hitherto he had, it seems, maintained all his children, with their families, in his own house, in the true style of an ancient patriarch); and spent his time in study and devotion: but the capricious tyrant would not suffer him to enjoy this tranquillity. Though now reduced to a private station, and even to indigence, his opinion of the legality of the king's marriage with Anne Boleyn was deemed of so much importance, that various means were tried to procure his approbation; but all persuasion proving ineffectual, he was, with some others, attainted in the house of lords of misprision of treason, for encouraging Elizabeth Barton, the nun of Kent, in her treasonable practices. His innocence in this affair appeared so clearly, that they were obliged to strike his name out of the bill. He was then accused of other crimes, but with the same effect; till, refusing to take the oath enjoined by the act of supremacy, he was committed to the Tower, and, after 15 months imprisonment, was tried at the bar of the King's-bench, for high treason, in denying the king's supremacy. The proof rested on the sole evidence of Rich the solicitor-general, whom Sir Thomas, in his defence, sufficiently discredited; nevertheless the jury brought him in guilty, and he was condemned to suffer as a traitor. The merciful Harry, however, indulged him with simple decollation; and he was accordingly beheaded on Tower-hill, on the 5th of July 1535. His body, which was first interred in the Tower, was begged by his daughter Margaret, and

and deposited in the chancel of the church at Chelsea, where a monument, with an inscription written by himself, had been some time before erected. This monument with the inscription is still to be seen in that church. The same daughter, Margaret, also procured his head after it had remained 14 days upon London-bridge, and placed it in a vault belonging to the Roper's family, under a chapel adjoining to St Dunstan's church in Canterbury. Sir Thomas More was a man of some learning, and an upright judge; a very priest in religion, yet cheerful, and even affectedly witty (A). He wanted not sagacity, where religion was out of the question; but in that his faculties were so enveloped, as to render him a weak and credulous enthusiast. He left one son and three daughters; of whom MARGARET, the eldest, was very remarkable for her knowledge of the Greek and Latin languages. She married a Mr Roper of Well-hall in Kent, whose Life of Sir Thomas More was published by Mr Hearne at Oxford in 1716. Mrs Roper died in 1544; and was buried in the vault of St Dunstan's in Canterbury, with her father's head in her arms.

Sir Thomas was the author of various works, though his *Utopia* is the only performance that has survived in the esteem of the world; owing to the rest being chiefly of a polemic nature: his answer to Luther has only gained him the credit of having the best knack of any man in Europe, at calling bad names in good Latin. His English works were collected and published by order of Queen Mary, in 1557; his Latin, at Basil, in 1563, and at Louvain in 1566.

MORE (Sir Antonio), an eminent painter, was born at Utrecht in 1719. He became a scholar of John Schorel, but seems to have studied the manner of Holbein, to which he approached nearer than to the freedom of design in the works of the great masters that he saw at Rome. Like Holbein he was a close imitator of nature, but did not arrive at his extreme delicacy of finishing; on the contrary, Antonio sometimes struck into a bold and masculine style, with a good knowledge of the chiaro scuro. In 1522, he drew Philip II. and was recommended by cardinal Granvelle to Charles V. who sent him to Portugal, where he painted John III. the king, Catherine of Austria his queen, and the infanta Mary first wife of Philip. For these three pictures he received 600 ducats, besides a gold chain of 1000 florins, and other presents. He had 100 ducats for his common portraits. But still ampler rewards were bestowed on him when sent into England, to draw the picture of queen Mary, the intended bride of Philip. They gave him 100l. a gold chain, and a pension of 100l. a quarter as painter to their majesties. He made various portraits of the queen; one was sent by cardinal Granvelle to the emperor, who ordered 200 florins to Antonio. He remained in England during the reign of Mary, and was much employed; but having neglected, as is frequent, to write the names on the portraits he drew, most of them have lost part of their value, by our ignorance of the persons represented. On the death of the queen, More followed Philip into Spain, where he was indulged in so much familiarity, that one day the king slapping him pretty roughly on the shoulder, More returned the sport with his hand-stick; a strange liberty (Mr Walpole observes), to be taken with a Spanish monarch, and with such a monarch! A grandee interposed for his pardon, and he was ordered to retire to the Netherlands; but a messenger was dispatched to recal him before he had finished his journey. The painter, however, sensible of the danger he had escaped, modestly excused himself, and proceeded. At Utrecht, he found the duke of Alva, and was employed by him to draw several of his mistresses, and was made receiver of the revenues of West Flanders; a preferment with which they say he was so elated, that he burned his easel and gave away his painting tools. More was a man of a stately and handsome presence; and often went to Brussels, where he lived magnificently. At what time or where he was knighted, is uncertain. He died at Antwerp in 1575, in the 56th year of his age. His portrait, painted by himself, is in the chamber of painters at Florence, with which the great duke, who bought it, was so pleased, that he ordered a cartel with some Greek verses, written by Antonio Maria Salvini his Greek professor, to be affixed to the frame. Another picture of himself, and one of his wife, were in the collection of Sir Peter Lely. King Charles had five pictures painted by this master. Mr Walpole mentions a number of others that are in England. But More did not always confine himself to portraits. He painted several historic pieces, particularly one much esteemed of the resurrection of Christ with two angels, and another of Peter and Paul. A painter, who afterwards sold it to the prince of Condé, got a great deal of money by showing it at the foire St Germain. He made a fine copy of Titian's Danae for the king; and left unfinished the Circumcision, designed for the altar in the church of our Lady at Antwerp.

MORE (Henry), an eminent English divine and philosopher, in the 17th century, was educated at Eton school, and in Christ-college in Cambridge, of which he became a fellow, and spent his life in a retired way, publishing a great number of excellent works. He refused bishoprics both in Ireland and England. He was an open-hearted sincere Christian philosopher, who studied to establish men in the belief of providence against atheism. Mr Hobbes was used to say, that if his own philosophy was not true, there was none

(A) This last disposition, we are told, he could not restrain even at his execution. The day being come, he ascended the scaffold, which seemed so weak that it was ready to fall; whereupon, "I pray (said he) see me safe up, and for my coming down let me shift for myself." His prayers being ended, he turned to the executioner, and with a cheerful countenance said, "Pluck up thy spirits, man, and be not afraid to do thy office; my neck is very short, take heed therefore thou strike not awry for saving thy honesty." Then laying his head upon the block, he bid him stay until he had put aside his beard, saying, "That had never committed any treason."

none that he ſhould ſooner like than our philoſopher's. His writings have been publiſhed together in Latin and Engliſh, folio.

More (Alexander), was born at Caſtros in 1616. His father was a Scotſman, and principal of the college which the Calviniſts had in that city. Alexander was ſent to Geneva, where he was made profeſſor of Greek and of Theology, and at the ſame time diſcharged the office of a paſtor. His violent love of women, and the irregularity of his conduct, excited a great number of enemies againſt him. Saumaiſe, informed of his diſagreeable ſituation, invited him to Holland, where he was firſt appointed profeſſor of Theology at Middleburgh, and afterwards profeſſor of hiſtory at Amſterdam. The duties of theſe ſtations he diſcharged with great ability; and in 1655 he went to Italy, where he remained a conſiderable time. It was during his travels in Italy that he publiſhed his beautiful poem on the defeat of the Turkiſh fleet by the Venetians; and this work procured him the preſent of a golden chain from the republic. Having taken a diſlike to Holland, he was tranſlated to Charenton. There his ſermons attracted a numerous audience, not ſo much for their eloquence as for the ſatirical alluſions and witticiſms with which they abounded. This kind of ſtyle ſucceeded with him, becauſe it was natural; but in his imitators it appeared altogether ridiculous. The impetuoſity of his character brought him into new quarrels, eſpecially with Daillé, who had greatly the better of him in the diſpute.—This ſingular man died at Paris September 20th, 1670, aged 54, in the houſe of the ducheſs de Rohan. He was never married. His works are, 1. A Collection of Controverſial Tracts. 2. Beautiful Orations and Poems, in Latin. 3. An anſwer to Milton, intitled, *Alexandri Mori fides publica.* Milton has attacked him with great ſeverity in his writings. Thoſe ſermons of his which are publiſhed, by no means juſtify the reputation which he had acquired for that kind of compoſition.

MOREA, formerly called the *Peloponneſus*, is a peninſula to the ſouth of Greece, to which it is joined by the iſthmus of Corinth. Its form reſembles a mulberry-leaf, and its name is derived from the great number of mulberry-trees which grow there. It is about 180 miles in length, and 130 in breadth. The air is temperate, and the land fertile, except in the middle, where it is full of mountains, and is watered by a great number of rivers. It is divided into three provinces; Scania, Belvedera, and Brazzo-di-Maina. It was taken from the Turks by the Venetians in 1687; but they loſt it again in 1715. The ſangiac of the Morea reſides at Modon. See Greece and Peloponnesus.

MOREAU (James), an eminent French phyſician, born at Chalons-ſur-Saone, was the diſciple and friend of the famous Guy Patin. He drew upon himſelf the jealouſy and hatred of the old phyſicians by the public theſes he maintained, and afterwards vindicated in his writings. He died in a very advanced age in 1729. He wrote in French, 1. Conſultations on the Rheumatiſm. 2. A chemical treatiſe on Fevers. 3. A phyſical diſſertation on the Dropſy; and other works which are eſteemed.

MOREELSE (Paul), an eminent painter, was born at Utrecht in 1575, and ſtudied painting under Michael Mirevelt. He was very ſucceſsful, not only in portraits, but hiſtorical ſubjects and architecture, particularly after he had improved his taſte by his ſtudies in Italy. We have ſome excellent wood-cuts in chiaro-ſcuro by this artiſt, who died in 1638.

MOREL, the name of ſeveral celebrated printers to the kings of France, who, like the Stephenſes, were alſo men of great learning.

Frederic Morel, who was interpreter in the Greek and Latin tongues, as well as printer to the king, was heir to Vaſcoſan, whoſe daughter he had married.—He was born in Champagne, and he died in an advanced age at Paris 1583. His ſons and grandſons trode in his ſteps; they diſtinguiſhed themſelves in literature, and maintained alſo the reputation which he had acquired by printing. The edition of *St Gregory of Nyſſa*, by his ſon Claude Morel, is held in great eſtimation by the learned.

Morel (Frederic), ſon of the preceding, and ſtill more celebrated than his father, was profeſſor and interpreter to the king, and printer in ordinary for the Hebrew, Greek, Latin, and French languages. He was ſo devoted to ſtudy, that when he was told his wife was at the point of death, he would not ſtir till he had finiſhed the ſentence which he had begun. Before it was finiſhed, he was informed that ſhe was actually dead; *I am ſorry for it* (replied he coldly) *ſhe was an excellent woman.* This printer acquired great reputation from the works which he publiſhed, which were very numerous and beautifully executed. From the manuſcripts in the king's library, he publiſhed ſeveral treatiſes of St Baſil, Theodoret, St Cyrille; and he accompanied them with a tranſlation. His edition of the works of Œcumenius and Aretas, in 2 vols folio, is much eſteemed. In ſhort, after diſtinguiſhing himſelf by his knowledge in the languages, he died June 27, 1630, at the age of 78. His ſons and grandſons followed the ſame profeſſion.

Morel (William), regius profeſſor of Greek, and director of the king's printing houſe at Paris, died 1564. He compoſed a *Dictionnaire Grec-Latin-François*, which was publiſhed in quarto in 1622, and ſome other works which indicate very extenſive learning. His editions of the Greek authors are exceedingly beautiful. This great ſcholar, who was of a different family from the preceding, had a brother named John, who died in priſon (where he had been confined for hereſy) at the age of 20, and whoſe body was dug out of the grave, and burnt Feb. 27, 1559. They were of the pariſh of Tilleul, in the county of Mortein, in Normandy.

Morel (Dom Robert), a benedictine monk of the ſociety of Saint-Maur, was born at Chaiſe-Dieu in Auvergne, A. D. 1653. He was appointed keeper of the library of Saint-Germain des Pres in 1680. He was afterwards ſuperior of different religious houſes. In 1699 he diſengaged himſelf from every care, and retired to Saint Denys, where he ſpent his time in compoſing works of practical religion. This learned monk, who enjoyed from nature a lively and fruitful imagination, excelled chiefly in ſubjects of piety, in a knowledge of the Chriſtian character, and of the rules which regard the conduct of the Chriſtian life. His converſation was ſprightly and refined, his anſwers were prompt and ingenious, his temper was gentle,

equable, and full of gaiety mingled with discretion. His slovenly appearance did not debase the beauty of his mind. All his words breathed charity, piety, uprightness, sincerity, and innocence of manners. Great simplicity and modesty, the limits of which he never transgressed, concealed his excellencies from the vulgar, but made him rank higher in the estimation of the wise and sensible part of mankind. Dom Morel died A. D. 1731, aged 79. His principal works are, 1. *Effusions de cœur sur chaque verse des Pseaumes et des Cantiques de l'Eglise;* Paris, 1716, in 5 vols. 12mo. P. de Tournemine, a Jesuit, esteemed this book (which abounds in pious and affecting thoughts and expressions) so much, that he perused it constantly; and when he was obliged to go to the country, he always carried a volume of it along with him. He earnestly sought to be introduced to the author, and intreated on his knees that he would grant him his benediction *(Histoire litteraire de la congregation de Saint Maur, p. 504.)* 2. *Entretiens spirituels sur les Evangiles des Dimanches et des Mysteres de toute l'année, distribués pour tous les jours de l'Avent*, 1720, 4 vols. 12mo. 3. *Entretiens spirituels, pour servir de preparation à la Mort*, 12mo, 1721. 4. *Imitation de N. S. I. C.* a new translation, with a pathetic prayer, or an effusion of the heart, at the conclusion of every chapter, in 12mo, 1723. 5. *Meditations Chretiennes sur les Evangiles de toute l'année*, 2 vols. 12mo, 1726. 6. *De l'Esperance Chretienne et de la Confiance en la misericorde de Dieu*, 12mo, 1728. The greater part of Morel's works are devotional; and his observations are drawn chiefly from the scriptures, and from the practical writings of the fathers. This circumstance greatly raised the reputation of his works, and at the same time excited the envy and ill-will of his enemies. By them he was considered as a Jansenist; and in this light he is represented in the *Dictionnaire des livres Jansenistes.*

Morel (Andreas), a very eminent antiquary, born at Berne in Switzerland. Having a strong passion for the study of medals, he travelled through several countries, and made large collections: in 1683 he published at Paris, in 8vo, *Specimen universæ rei nummariæ antiquæ*: and the great work of which this was the specimen was to be a complete collection of all ancient medals, of which he had at that time 20,000 exactly designed. Soon after this essay appeared, Louis XIV. gave him a place in his cabinet of antiques, in which capacity he brought himself into great danger by speaking too freely of M. Louvois on account of the neglect in paying his salary, or on some other private account, as he was committed to the Bastile, where he lay for three years; nor was he released until the death of Louvois, nor till the canton of Berne had interceded in his favour. He afterward accepted an invitation from the count of Schwartzburg at Arnstadt, in Germany, with whom he lived in the capacity of antiquary, and was furnished with every thing necessary for carrying on his grand work. In 1703 he died; and in 1734 came out at Amsterdam part of this collection, in 2 vols. folio, under the title of *Thesaurus Morellianus, sive familiarum Romanorum numismata omnia, diligentissimè undique conquisita,* &c. *Nunc primum edidit & commentario perpetuo illustravit Sigibertus Havercampus.* These volumes contain an explication of 3539 medals, engraved, with their reverses.

MORENA, (anc. geog.), a district or division of Mysia, in the Hither Asia. A part of which was occupied by Cleon, formerly at the head of a band of robbers, but afterwards priest of Jupiter Abrettenus, and enriched with possessions, first by Antony, and then by Cæsar.

MORESBY, a harbour a litttle above Whitehaven, in Cumberland; in and about which many remains of antiquity have been dug up, such as altars and stones, with inscriptions on them; and several caverns have been found called Pict's Holes. Here is supposed to have been a Roman fortification.

MORESQUE, Moresk, or *Morisko*, a kind of painting, carving, &c. done after the manner of the Moors; consisting of several grotesque pieces and compartiments promiscuously intermingled, not containing any perfect figure of a man, or other animal, but a wild resemblance of birds, beasts, trees, &c. These are also called *arabesques*, and are particularly used in embroideries, damask-work, &c.

Moresque-Dances, vulgarly called *Morrice-dances*, are those altogether in imitation of the Moors, as sarabands, chacons, &c. and are usually performed with castanets, tambours, &c.

There are few country places in England where the morrice-dance is not known. It was probably introduced about, or a little before, the reign of Henry VIII. and is a dance of young men in their shirts, with bells at their feet, and ribbands of various colours tied round their arms and flung across their shoulders.

MORETON, a town of Devonshire, with a market on Saturdays, seated on a hill, near Dartmore, and is a pretty large place, with a noted market for yarn. It is 14 miles south-west of Exeter, and 185 west by south of London. W. Long. 3. 46. N. Lat. 50. 39.

Moreton, a town in Gloucestershire, whose market is disused. It is a good thoroughfare, and seated on the Fosseway, 29 miles east-south-east of Worcester, and 83 west-north-west of London. W. Long. 1. 36. N. Lat. 52. 0.

MORGAGNA. See Fata.

MORGAGNI (John Baptist), doctor of medicine, first professor of anatomy in the university of Padua, and member of several of the most eminent societies of learned men in Europe, was born in the year 1682, at Forli, a town in the district of *La Romagna* in Italy. His parents, who were in easy circumstances, allowed him to follow that course in life his genius dictated. He began his studies at the place of his nativity; but soon after removed to Bologna, where he obtained the degree of Doctor of Medicine, when he had but just reached the 16th year of his age. Here his peculiar taste for anatomy found an able preceptor in Valsalva, who bestowed on him the utmost attention; and such was the progress he made under this excellent master, that at the age of 20 he himself taught anatomy with high reputation. Soon, however, the fame of his prelections, and the number of his pupils, excited the jealousy of the public professors, and gave rise to invidious persecutions. But his abilities and prudence gained him a complete triumph over his enemies; and all opposition to him was finally terminated from his being appointed by the senate of Bologna to fill a medical chair, which soon became vacant. But the duties of this office, although important, neither occupied

pied the whole of his time, nor ſatisfied his anxious deſire to afford inſtruction. He ſtill continued to labour in ſecret on his favourite ſubject, and ſoon after communicated the fruits of theſe labours to the public in his *Adverſaria Anatomica*, the firſt of which was publiſhed in the year 1706, the ſecond and third in 1717, and the three others in 1719. The publication of this excellent work ſpread the fame of Morgagni far beyond the limits of the ſtate of Bologna. Such was his reputation, that the wiſe republic of Venice had no heſitation in making him an offer of the ſecond chair of the theory of medicine in the univerſity of Padua, then vacant by the death of M. Molinetti; and, to enſure his acceptance, they doubled the emoluments of that appointment. While he was in this department, he publiſhed his treatiſe, entitled *Nova inſtitutionum medicarum idea*, which firſt appeared at Padua in the year 1712. From this work his former reputation ſuffered no diminution. And ſoon after he roſe, by different ſteps, to be firſt profeſſor of anatomy in that celebrated univerſity. Although Morgagni was thus finally ſettled at Padua, yet he gave evident proofs of his gratitude and attachment to Bologna, which he conſidered as his native country with reſpect to the ſciences. He exerted his utmoſt efforts in eſtabliſhing the academy of Bologna, of which he was one of the firſt aſſociates; and he enriched their publications with ſeveral valuable and curious papers. Soon after this, the royal ſocieties of London and Paris received him among their number. Not long after the publication of his *Adverſaria Anatomica*, he began, much upon the ſame plan, his *Epiſtolæ Anatomicæ*, the firſt of which is dated at Padua in the beginning of April 1726. The works of Morgagni which have already been mentioned, are to be conſidered, in a great meaſure, as ſtrictly anatomical: but he was not more eminent as an anatomiſt, than as a learned and ſucceſsful phyſician. In the year 1760, when he was not far diſtant from the 80th year of his age, he publiſhed his large and valuable work *De cauſis et ſedibus morborum per anatomen indagatis*. This laſt and moſt important of all his productions will afford convincing evidence of his induſtry and abilities to lateſt poſterity. Beſides theſe works, he publiſhed, at different periods of his life, ſeveral miſcellaneous pieces, which were afterwards collected into one volume, and printed under his own eye at Padua, in the year 1765. It does not appear that he had in view any future publications; but he intended to have favoured the world with a complete edition of all his works, which would probably have been augmented with many new obſervations. In this he was engaged when, on the 5th of December 1771, after he had nearly arrived at the 90th year of his age, death put a period to his long and glorious career in the learned world.

MORGANA, or MORGAGNA, *Fata*. See FATA.

MORGES, a handſome and rich town of Swiſſerland, in the canton of Bern, and capital of a bailiwick, with a caſtle where the bailiff reſides. It is a place of ſome trade on account of a canal, from which they tranſport merchandizes from the lake of Geneva to other parts. There is a fine proſpect from it; and it is ſeated on the lake of Geneva, five miles from Lauſanne. E. Long. 6. 42. N. Lat. 46. 29.

MORGO, anciently *Amorgos*, an iſland in the Archipelago, fertile in wine, oil, and corn. It is well cultivated, and the inhabitants are affable, and generally of the Greek church The beſt parts belong to a monaſtery. The greateſt inconvenience in this iſland is the want of wood. It is 30 miles in circumference. E. Long. 26. 15. N. Lat. 36. 30.

MORHANGE, a town of Germany, in Lorrain, whoſe lord has the title of Rhinegrave, and depends on the empire. It is 24 miles north-eaſt of Nanci, and 200 eaſt of Paris. E. Long. 6. 42. N. Lat. 48. 51.

MORHOFF (Daniel George), a very learned German, born at Wiſmar in the duchy of Mecklenburgh, in 1639. The duke of Holſtein, when he founded an univerſity at Kiel, made him profeſſor of eloquence and poetry there in 1665; to which was afterwards added the profeſſorſhip of hiſtory, and in 1680 the office of librarian to the univerſity. He was the author of many works of a ſmall kind; as orations, diſſertations, theſes, and poems: but his chief work was his *Polyhiſtor, ſive de notitia auctorum et rerum commentarii*; firſt publiſhed at Lubec in 1688; which has been greatly enlarged ſince his death in 1691, and gone through ſeveral ſucceſſive editions.

MORIAH, one of the eminences of Jeruſalem; on which Abraham went to offer his ſon, and David wanted to build the temple, which was afterwards executed by Solomon: The threſhing-floor of Araunah; originally narrow, ſo as ſcarce to contain the temple, but enlarged by means of ramparts; and ſurrounded with a triple wall, ſo as to add great ſtrength to the temple, (Joſephus). It may be conſidered as a part of Mount Sion, to which it was joined by a bridge and gallery, *(Id.)*

MORILLES, a kind of muſhroom, about the bigneſs of a walnut, pierced with holes like a honeycomb, and ſaid to be good for creating an appetite. They are alſo accounted reſtorative, and frequently uſed in ſauces and ragouts.

MORILLOS (Bartholomew), of Seville in Spain, was born A. D. 1613. After having cultivated painting with ſucceſs in his own country, he travelled into Italy, where he was greatly admired for a manner peculiar to himſelf, and capable of producing a wonderful effect. The Italians, aſtoniſhed at the excellence of his genius and the freſhneſs of his colouring, did not heſitate to compare him to the celebrated Paul Veroneſe. On his return to Spain, Charles II. brought him to court, with the intention of making him his firſt painter; but Morillos declined the offer, pretending, as an excuſe, that his age would not permit him to accept of an employment of ſuch importance. His extreme modeſty, however, was the ſole cauſe of his refuſal. He died in 1685, aged 72 years.

MORIN (John Baptiſt), phyſician and regius profeſſor of mathematics at Paris, was born at Villefranche in Beaufolois, in 1583. After commencing doctor at Avignon, he went to Paris, and lived with Claude Dormi biſhop of Boulogne, who ſent him to examine the mines of Hungary; and thereby gave occaſion to his *Mundus ſublunaris anatomia*, which was his firſt production, and publiſhed in 1619. Upon his return to his patron the biſhop, he contracted an attachment to

Morin.

judicial aſtrology, concerning which he furniſhed the world with many ridiculous ſtories, and wrote a great number of books not worth enumerating. He died in 1656, before he had finiſhed the favourite labour of his life, which was his *Aſtrologia Gallica*. Louiſa Maria de Gonzaga queen of Poland gave 2000 crowns to carry on the edition, at the recommendation of one of her ſecretaries, who was a lover of aſtrology; and it appeared at the Hague in 1661, in one vol. folio, with two dedications, one to Jeſus Chriſt, and another to the queen of Poland.

Morin (John), a very learned Frenchman, born at Blois, of Proteſtant parents, in 1591; but converted by cardinal du Perron to the catholic religion. He publiſhed, in 1626, ſome Exercitations upon the original of Patriarchs and Primates, and the ancient uſage of eccleſiaſtical cenſures; dedicated to pope Urban VIII. In 1628 he undertook the edition of the Septuagint Bible, with Nobilus's verſion; and placed a preface before it, in which he treats of the authority of the Septuagint, and prefers the verſion in the edition made at Rome by order of Sixtus V. to the preſent Hebrew text, which he affirms has been corrupted by the Jews. About the ſame time he gave a French Hiſtory of the deliverance of the church by the emperor Conſtantine, and of the temporal greatneſs conferred on the Roman church by the kings of France. He afterwards publiſhed Exercitations upon the Samaritan Pentateuch; and took the care of the Samaritan Pentateuch, for the Polyglot then preparing at Paris. He was greatly careſſed at Rome; where, after living nine years at the invitation of cardinal Barbarini, he was recalled by Cardinal Richelieu, and died at Paris in 1659. His works are very numerous; and ſome of them as much valued by Proteſtants as Papiſts for the oriental learning they contain.

Morin (Simon), a celebrated fanatic of the 17th century, was born at Richemont, near Aumale, and had been clerk to Mr Charron, general paymaſter of the army. He was very ignorant and illiterate; and therefore it is no wonder if, meddling in ſpiritual matters, he fell into great errors. He was not content with broaching his whimſies in converſation, but wrote them down in a book, which he cauſed to be privately printed in 1647, under the title of *Penſées de Morin dediées au Roi.* This book is a medley of conceit and ignorance, and contains the moſt remarkable errors which were afterwards condemned in the Quietiſts: only that Morin carries them to a greater length than any one elſe had done; for he affirms, "that the moſt enormous ſins do not remove a ſinner from the ſtate of grace, but ſerve on the contrary to humble the pride of man." He ſays, "that in all ſects and nations God has a number of the elect, true members of the church; that there would ſoon be a general reformation, all nations being juſt about to be converted to the true faith; and that this great reformation was to be effected by the ſecond coming of Jeſus Chriſt, and Morin incorporated with him."—He was in priſon at Paris, at the time when Gaſſendi's friends were writing againſt the aſtrologer John Baptiſt Morin, whom they upbraided (but, as he replied, falſely) with being the brother of this fanatic. This was about 1650; after which Simon Morin was ſet at liberty as a viſionary; and ſuffered to continue ſo till 1661, when Des Marets de St Sorlin, who, though a fanatic and viſionary himſelf, had conceived a violent averſion to him, diſcovered his whole ſcheme, and had him taken up. The means Des Marets made uſe of for this diſcovery was by pretending to be one of his diſciples; and he carried his treachery and diſſimulation ſo far, as to acknowledge him for "the Son of man riſen again." This acknowledgement ſo pleaſed Morin, that he conferred upon him, as a particular grace, the office of being his harbinger, calling him *a real John the Baptiſt revived.* Then Des Marets impeached him, and became his accuſer; upon which Morin was brought to a trial, and condemned to be burnt alive. This ſentence was executed on him at Paris, March 14th, 1663, in the form and manner following: After having made the *amende honorable* in his ſhirt, with a cord about his neck and a torch in his hand, before the principal gate of the church of Notre Dame, he was carried to the place of execution, and there tied to a ſtake to be burnt alive, together with his book intituled *Penſées de Morin*, as alſo all his papers and his trial. Afterwards his aſhes were thrown into the air, as a puniſhment for his having aſſumed the title of the Son of God. His accomplices, too, were condemned to aſſiſt at his execution, and then to ſerve in the galleys for life, after having been whipped by the hangman, and marked with a burning iron with *fleurs de lis* upon the right and left ſhoulders. Morin gave out that he would riſe again the third day; which made many of the mob gather together at the place where he was burnt.—It is ſaid, that when the preſident de Lamoignon aſked him, whether it was written in any part of Scripture, that the great prophet or new Meſſiah ſhould paſs through the fire? he cited this text by way of anſwer: *Igne me examinaſti, et non eſt inventa in me iniquitas;* that is, "Thou haſt tried me with fire, and no wickedneſs hath been found in me." Morin died with remarkable reſolution; and it was then thought the judges had been too rigorous in their ſentence, and that ſending him to a mad-houſe would have been ſufficient. They replied in defence of themſelves, that Morin had owned many impious tenets; and that not in ſudden ſtarts and fits of heat, but in cool blood, and with deliberate obſtinacy. But then a queſtion will ariſe, whether a fool, any more than a madman, ought to be capitally puniſhed for any opinion or degree of ſtubbornneſs?

Morin (Peter), was born at Paris, A. D. 1531: he went into Italy, and was employed by the learned Paulus Manucius in his printing-houſe at Venice.—He afterwards taught Greek and coſmography at Vicencia, whence he was called to Ferrara by the duke of that name. St Charles Borromeus, informed of his profound knowledge in eccleſiaſtical antiquities, of his diſintereſtedneſs, of his zeal and piety, offered him his friendſhip, and engaged him to go to Rome in 1575. The popes Gregory XIII. and Sixtus V. employed him in an edition of the Septuagint, 1587, and in one of the Vulgate, 1590, in folio. He alſo ſpent much of his time on an edition of the Bible tranſlated from the Septuagint, and publiſhed at Rome, 1588, in folio; on an edition of the Decretals to the time

the time of Gregory VII. publifhed at Rome, 1591; and on a Collection of General Councils, likewife publifhed at Rome, 1608, 4 vols. This learned critic died at Rome, 1608, aged 77. His character was open, fimple, fincere, gentle, and honeft: his temper was equal and agreeable. He was an enemy to artifice and cunning; he defpifed riches and honours; and he feemed to have a paffion for nothing but ftudy.—He fpoke Italian with as much eafe and propriety as the moft intelligent native. He left behind him *Un Traité du bon ufage des Sciences*, and fome other writings, publifhed by Father Quetif, a Dominican friar, in 1675. His works difplay great refearch and excellent principles; and the author appears to have been well acquainted with the belles lettres and the languages. His edition of the Septuagint, printed at Rome, 1687, in folio, is now very fcarce.

Morin (Stephen), minifter of the Proteftant reformed religion at Caen, the place of his birth, was admitted a member of the Academy of Belles Lettres in that city, notwithftanding an exprefs law which excluded Proteftants. His great learning gained him this mark of diftinction. After the revocation of the edict of Nantes, he retired to Leyden in 1685, and from that to Amfterdam, where he was appointed profeffor of Oriental languages. He died in 1700, at the age of 75, after being long fubject to infirmities both of body and mind. He publifhed eight differtations in Latin relating to fubjects of antiquity, which are extremely curious. The Dordrecht edition of 1700, 8vo, is the beft, and preferable to that publifhed at Geneva in 1683, 4to. He wrote likewife the life of Samuel Bochart.

Morin (Henry), fon to the preceding, was born at Saint-Pierre-Sur-Dive, in Normandy, and became a Roman Catholic after he had been a Proteftant minifter. He is the author of feveral differtations which are to be found in the Memoirs of the Academy of Infcriptions, of which he was a member. He died at Caen, on the 16th of July 1728, aged 60, as much efteemed as his father.

Morin (Lewis,), was born at Mans in 1635. He went on foot to Paris to ftudy philofophy, and collected herbs during the whole journey. He afterwards ftudied phyfic, and lived in the manner of an anchorite, bread and water, or at moft but a few fruits, being his whole fubfiftence. Paris was to him a hermitage; with this exception, that it furnifhed him with books, and with the converfation and acquaintance of the learned. He received the degree of doctor of medicine in 1662; and, after feveral years practice, he was expectant at the Hotel-Dieu. His reputation made Mademoifelle de Guife choofe him for her firft phyfician, and the Academy of Sciences for one of its members. He died A. D. 1715, aged 80. A long and vigorous life, with a gentle and eafy death, were the rewards of his temperance. The exercifes of religion and the duties of his ftation occupied his whole time. No part of it was fpent in paying or receiving vifits. "Thofe who come to fee me (faid he) do me honour; thofe who do not come, lay me under an obligation." "It was only an Anthony (faid Fontenelle) who could vifit this Paul" He left a library valued at 20,000 crowns, an herbal, together with a cabinet of medals; and this feems to have been his whole fortune. His mental enjoyments had been much more expenfive than thofe of the body. An index to Hippocrates, in Greek and Latin, much more copious and better finifhed than that of Pinus, was found among his papers.

Morin (John), was born at Meung near Orleans in 1705, and in 1732 he was appointed profeffor of philofophy at Chartres. In 1750 the bifhop of Chartres rewarded his long and affiduous attention to claffical learning by a canonry in the cathedral. At the age of 38, Morin publifhed his *Mecanifme Univerfel*, one volume 12mo, which contains a great deal of information, but much more conjecture. His next work was a Treatife on Electricity, publifhed in 1748. His third and laft performance was an anfwer to the Abbé Nollet, who had attacked his opinions concerning electricity. His reputation was not limited to the province in which he lived: he was well known to the academies of fciences at Paris and Rouen, with whom he frequently correfponded. He continued his application to the fciences, and difplayed the virtues of the prieft and the philofopher to the laft hour of his life. This valuable man died at Chartres, on the 28th of March 1764, at the age of 59.

MORINA, in botany: A genus of the monogynia order, belonging to the diandria clafs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The corolla is unequal; the calyx of the fruit is monophyllous and dented; the calyx of the flower bifid; there is one feed under the calyx of the flower.

MORINORUM Castellum (anc. geog.), fimply Caftellum (Antonine); fituated on an eminence, with a fpring of water on its top, in the territory of the Morini. Now *Mont Caffel*, in Flanders.

MORINDA, in botany: A genus of the monogynia order, belonging to the pentandria clafs of plants; and in the natural method ranking under the 48th order, *Aggregatæ*. The flowers are aggregate and monopetalous; the ftigmata bifid; the fruit plums aggregate, or in clufters.

MORISON (Robert), phyfician and profeffor of botany at Oxford, was born at Aberdeen in 1620, bred at the univerfity there, and taught philofophy for fome time in it; but having a ftrong inclination to botany, made great progrefs in it. The civil wars obliged him to leave his country; which, however, he did not do till he had firft fignalized his zeal for the intereft of the king, and his courage, in a battle fought between the inhabitants of Aberdeen and the Prefbyterian troops on the bridge of Aberdeen, in which he received a dangerous wound on the head. As foon as he was cured of it, he went into France; and fixing at Paris, he applied affiduoufly to botany and anatomy. He was introduced to the duke of Orleans, who gave him the direction of the royal gardens at Blois. He exercifed the office till the death of that prince, and afterwards went over to England in 1660. Charles II. to whom the duke of Orleans had prefented him at Blois, fent for him to London, and gave him the title of his *phyfician*, and that of *profeffor royal of botany*, with a penfion of 200 l. *per annum*. The *Præludium Botanicum*, which he publifhed in 1669, procured him fo much reputation, that the univerfity of Oxford invited him to the profefforfhip of botany in 1669; which

Morisonia, Morlachia. which he accepted, and acquitted himself in it with great ability. He died at London in 1683, aged 63. He published a second and third part of his History of Plants, in 2 vols, folio; with this title, *Plantarum Historia Oxoniensis Universalis.* The first part of this excellent work has not been printed; and it is not known what has become of it.

MORISONIA, in botany: A genus of the polyandria order, belonging to the monadelphia class of plants; and in the natural method ranking under the 25th order, *Putamineæ.* The calyx is single and bifid; the corolla tetrapetalous; there is one pistil; the berry has a hard bark, is unilocular, polyspermous, and pedecellated.

MORLACHIA, a mountainous country of Dalmatia. The inhabitants are called *Morlacks* or *Morlacchi;* they inhabit the pleasant valleys of Koter, along the rivers Kerha, Cettina, Narenta, and among the inland mountains of Dalmatia. The inhabitants are by some said to be of Walachian extraction, as (according to these authors) is indicated even by their name; Morlachia being a contraction of *Mauro-Walachia*, that is, *Black Walachia:* and the Walachians are said to be descendants of the ancient Roman colonies planted in these countries. This, however, is denied by the Abbé Fortis, who hath published a volume of travels into that country. He informs us, that the origin of the Morlacchi is involved in the darkness of barbarous ages, together with that of many other nations, resembling them so much in customs and language, that they may be taken for one people, dispersed in the vast tracks from the Adriatic sea to the frozen ocean. The emigrations of the various tribes of the Slavi, who, under the names of *Scythians*, *Geti*, *Goths*, *Hunns*, *Slavini*, *Croats*, *Avari*, and *Vandals*, invaded the Roman empire, and particularly the Illyrian provinces during the decline of the empire, must have strangely perplexed the genealogies of the nations which inhabited it, and which perhaps removed thither in the same manner as at more remote periods of time. The remainder of the Ardiæi, Autariati, and other Illyrian people anciently settled in Dalmatia, who probably could not reconcile themselves to a dependence on the Romans, might nevertheless naturally enough form an union with foreign invaders not unlike themselves in dialect and customs; and, according to our author, it seems no ill-founded conjecture, that many families, driven out of Hungary by the irruption of the Moguls under Jenghiz Khan and his successors, might people the deserted valleys between the mountains of Dalmatia. This conjecture is also somewhat confirmed by the traces of the Calmuck Tartars, which are still to be found in a part of that country called *Zara.*

With regard to the etymology of the name, the Abbé observes, that the Morlacchi generally call themselves, in their own language, *Vlassi;* a national term, of which no vestige is found in the records of Dalmatia till the 13th century. It signifies *powerful men*, or *men of authority;* and the denomination of *Moro Vlassi*, corruptly *Morlacchi*, as they are now called, may perhaps point out the original of the nation. This word may possibly signify the *conquerors that came from the sea; Moor*, in all the dialects of the Sclavonian language, signifying the *sea.*

The Morlacchi are so different from the inhabitants Morlachia. of the sea-coasts in dialect, dress, dispositions, and customs, that they seem clearly to be of a different original, or at least the colonies must have settled at such distant periods from each other, that they have had time to alter in a great measure their national character. There is also a remarkable diversity among the Morlacchi themselves in several districts, probably on account of the different countries from whence they came.

With regard to the character of these people, we are informed that they are much injured by their maritime neighbours. The inhabitants of the sea-coast of Dalmatia tell many frightful stories of their avarice and cruelty: but these, in our author's opinion, are all either of an ancient date, or if any have happened in latter times, they ought rather to be ascribed to the corruption of a few individuals, than to the bad disposition of the nation in general; and though thievish tricks are frequent among them, he informs us, that a stranger may travel securely through their country, where he is faithfully escorted, and hospitably treated. The greatest danger is from the *Haiduks* or *Banditti*, of whom there are great numbers among the woods and caves of these dreadful mountains on the confines. There, says our author, a man ought to get himself escorted by a couple of these "honest fellows;" for they are not capable of betraying him although a banditti; and their situation is commonly more apt to raise compassion than diffidence. They lead their life among the wolves, wandering from one precipice to another, exposed to the severity of the seasons, and frequently languish in want of the necessaries of life, in the most hideous and solitary caverns. Yet they very seldom disturb the tranquillity of others, and prove always faithful guides to travellers; the chief objects of their rapine being sheep and oxen, to supply themselves with food and shoes. Sometimes it happens, that, in their extreme necessity, the Haiduks go in parties to the shepherds cottages, and rudely demand something to eat; which they do not fail to take immediately by force if the least hesitation is made. It is seldom indeed that they meet with a refusal, or with resistance, as their resolution and fury are well known to be equal to the savage life they lead. Four Haiduks are not afraid to assault a caravan of 15 or 20 Turks, and generally plunder and put them to flight. The greatest part of the Haiduks look upon it as a meritorious action to shed the blood of the Turks; to which cruelty they are easily led by their natural ferocity, inflamed by a mistaken zeal for religion, and the discourses of their fanatic priests.

As to the Morlacchi themselves, they are represented as open and sincere to such a degree, that they would be taken for simpletons in any other country; and by means of this quality they have been so often duped by the Italians, that *the faith of an Italian* and *the faith of a dog* are synonymous among the Morlacchi. They are very hospitable to strangers; and their hospitality is equally conspicuous among the rich and poor. The rich prepares a roasted lamb or sheep, and the poor with equal cordiality offers whatever he has; nor is this generosity confined to strangers, but generally extends itself to all who are in want.

Morlachia.

When a Morlack is on a journey, and comes to lodge at a friend's houfe, the eldeft danghter of the family, or the new-married bride if there happens to be one, receives and kiffes him when he alights from his horfe or at the door of the houfe: but a foreigner is rarely favoured with thefe female civilities; on the contrary, the women, if they are young, hide themfelves, and keep out of his way.

The Morlacchi in general have little notion of domeftic œconomy, and readily confume in a week as much as would be fufficient for feveral months, whenever any occafion of merriment prefents itfelf. A marriage, the holiday of the faint, protector of the family, the arrival of relations or friends, or any other joyful incident, confumes of courfe all that there is to eat and to drink in the houfe. Yet the Morlack is a great œconomift in the ufe of his wearing-apparel; for rather than fpoil his new cap, he takes it off, let it rain ever fo hard, and goes bareheaded in the ftorm. In the fame manner he treats his fhoes, if the road is dirty and they are are not very old. Nothing but an abfolute impoffibility hinders a Morlack from being punctual; and if he cannot repay the money he borrowed at the appointed time, he carries a fmall prefent to his creditor, and requefts a longer term. Thus it happens fometimes, that, from term to term, and prefent to prefent, he pays double what he owed, without reflecting on it.

Friendfhip, that among us is fo fubject to change on the flighteft motives, is lafting among the Morlacchi. They have even made it a kind of religious point, and tie the facred bond at the foot of the altar. The Sclavonian ritual contains a particular benediction for the folemn union of two male or two female friends in the prefence of the congregation. The male friends thus united are called *Pobratimi*, and the female *Pofeftreme*, which mean half-brothers and half-fifters. Friendfhips between thofe of different fexes are not at this day bound with fo much folemnity, though perhaps in more ancient and innocent ages it was alfo the cuftom.

From thefe confecrated friendfhips among the Morlacchi and other nations of the fame origin, it fhould feem that the *fworn brothers* arofe; a denomination frequent enough among the common people of Italy and in many parts of Europe. The difference between thefe and the Pobratimi of Morlacchia confifts not only in the want of the ritual ceremony, but in the defign of the union itfelf. For, among the Morlacchi, the fole view is reciprocal fervice and advantage; but fuch a brotherhood among the Italians is generally commenced by bad men, to enable them the more to hurt and difturb fociety. The duties of the Pobratimi are, to affift each other in every cafe of need or danger, to revenge mutual wrongs, and fuch like. The enthufiafm is often carried fo far as to rifk and even to lofe their life for the Pobratimi, although thefe favage friends are not celebrated like a Pylades. If difcord happens to arife between two friends, it is talked of over all the country as a fcandalous novelty; and there has been fome examples of it of late years, to the great affliction of the old Morlacchi, who attribute the depravation of their countrymen to their intercourfe with the Italians. Wine and ftrong liquors, of which the nation is beginning to make daily abufe, will of courfe produce the fame bad effects as among others.

Morlachia.

But as the friendfhips of the Morlacchi are ftrong and facred, fo their quarrels are commonly unextinguifhable. They pafs from father to fon; and the mothers fail not to put their children in mind of their duty to revenge their father if he has had the misfortune to be killed, and to fhow them often the bloody fkirt and arms of the dead. And fo deeply is revenge rooted in the minds of this nation, that all the miffionaries in the world would not be able to eradicate it. A Morlack is naturally inclined to do good to his fellow-creatures, and is full of gratitude for the fmalleft benefit; but implacable if injured or infulted.

A Morlack who has killed another of a powerful family, is commonly obliged to fave himfelf by flight, and to keep out of the way for feveral years. If during that time he has been fortunate enough to efcape the fearch of his purfuers, and has got a fmall fum of money, he endeavours to obtain pardon and peace; and, that he may treat about the conditions in perfon, he afks and obtains a fafe conduct, which is faithfully maintained, though only verbally granted. Then he finds mediators; and, on the appointed day, the relations of the two hoftile families are affembled, and the criminal is introduced, dragging himfelf along on his hands and feet, the mufket, piftol, or cutlafs, with which he committed the murder, hung about his neck; and while he continues in that humble pofture, one or more of the relations recites a panegyric on the dead, which fometimes rekindles the flames of revenge, and puts the poor proftrate in no fmall danger. It is the cuftom in fome places for the offended party to threaten the criminal, holding all kind of arms to his throat, and, after much intreaty, to confent at laft to accept of his ranfom. Thefe pacifications coft dear in Albania; but the Morlacchi make up matters fometimes at a fmall expence; and every-where the bufinefs is concluded with a feaft at the offender's charge.

The Morlacks, whether they happen to be of the Roman or of the Greek church, have very fingular ideas about religion; and the ignorance of their teachers daily augments this monftrous evil. They are as firmly perfuaded of the reality of witches, fairies, enchantments, nocturnal apparitions, and fortileges, as if they had feen a thoufand examples of them. Nor do they make the leaft doubt about the exiftence of vampires; and attribute to them, as in Tranfylvania, the fucking the blood of infants. Therefore, when a man dies fufpected of becoming a vampire, or *vukodlak*, as they call it, they cut his hams, and prick his whole body with pins; pretending, that after this operation he cannot walk about. There are even inftances of Morlacchi, who, imagining that they may poffibly thirft for childrens blood after death, intreat their heirs, and fometimes oblige them to promife, to treat them as vampires when they die.

The boldeft Haiduk would fly trembling from the apparition of a fpectre, ghoft, phantom, or fuch like goblins as the heated imaginations of credulous and prepoffeffed people never fail to fee. Nor are they afhamed, when ridiculed for this terror; but anfwer, much in the words of Pindar; "Fear that proceeds from

Morlachia. from ſpirits, cauſes even the ſons of the gods to fly." The women, as may be naturally ſuppoſed, are a hundred times more timorous and viſionary than the men; and ſome of them, by frequently hearing themſelves called *witches*, actually believe they are ſo.

A moſt perfect diſcord reigns in Morlachia, as it generally does in other parts, between the Latin and Greek communion, which their reſpective prieſts fail not to foment, and tell a thouſand little ſcandalous ſtories of each other. The churches of the Latins are poor, but not very dirty: thoſe of the Greeks are equally poor, and ſhamefully ill kept. Our author has ſeen the curate of a Morlack village ſitting on the ground in the church-yard, to hear the confeſſion of women on their knees by his ſide: a ſtrange poſture indeed! but a proof of the innocent manners of thoſe good people, who have the moſt profound veneration for their ſpiritual paſtors, and a total dependence upon them; who, on their part, frequently make uſe of a diſcipline rather military, and correct the bodies of their offending flock with the cudgel. Perhaps this particular is carried to an abuſe as well as that of public penance, which they pretend to inflict after the manner of the ancient church. They moreover, thro' the ſilly credulity of thoſe poor mountaineers, draw illicit profits, by ſelling certain ſuperſtitious ſcrolls and other ſcandalous merchandiſe of that kind. They write in a capricious manner on the ſcrolls called *zapiz*, ſacred names which ought not to be trifled with, and ſometimes adding others very improperly joined. The virtues attributed to theſe zapiz are much of the ſame nature as thoſe which the Baſilians attributed to their monſtrouſly cut ſtones. The Morlacchi uſe to carry them ſewed to their caps, to cure or to prevent diſeaſes; and they alſo tie them for the ſame purpoſe to the horns of their oxen. The compoſers of this trumpery take every method to maintain the credit of their profitable trade, in ſpite of its abſurdity, and the frequent proofs of its inutility. And ſo great has their ſucceſs been, that not only the Morlacchi, but even the Turks near the borders, provide themſelves plentifully with zapiz from the Chriſtian prieſts, which not a little increaſes their income, as well as the reputation of the commodity. The Morlacchi have alſo much devotion, and many of the ignorant people in Italy have little leſs, to certain copper and ſilver coins of the low empire; or to Venetian cotemporary pieces, which paſs among them for medals of St Helen; and they think they cure the epilepſy and ſuch like. They are equally fond of an Hungarian coin called *petizza*, which has the virgin and child on the reverſe; and one of theſe is a moſt acceptable preſent to a Morlack.

The bordering Turks not only keep with devotion the ſuperſtitious zapiz, but frequently bring preſents and cauſe maſſes to be celebrated to the images of the Virgin; which is doubtleſs in contradiction to the alcoran; yet when ſaluted, in the uſual manner in that country, by the name of *Jeſus*, they do not anſwer. Hence, when the Morlacchi, or other travellers, meet them on the confines, they do not ſay, *Huaglian Iſſus*, "Jeſus be praiſed;" but, *Huaglian Bog*, "God be praiſed."

Innocence, and the natural liberty of paſtoral ages, are ſtill preſerved among the Morlacchi, or at leaſt many traces of them remain in the places fartheſt diſtant from our ſettlements. Pure cordiality of ſentiment is not there reſtrained by other regards, and diſplays itſelf without any diſtinction of circumſtances. A young handſome Morlack girl, who meets a man of her diſtrict on the road, kiſſes him affectionately, without the leaſt malice or immodeſt thought; and our author has ſeen all the women and girls, all the young men and old, kiſſing one another as they came into the church-yard on a holiday; ſo that they looked as if they had been all belonging to one family. He hath often obſerved the ſame thing on the road, and at the fairs in the maritime towns, where the Morlacchi came to ſell their commodities. In times of feaſting and merriment, beſides the kiſſes, ſome other little liberties are taken with the hands, which we would not reckon decent, but are not minded among them; and when they are told of it, they anſwer, It is only toying, and means nothing. From this toying, however, their amours often take their beginning, and frequently end ſeriouſly when the two lovers are once agreed. For it very rarely happens, in places far diſtant from the coaſt, that a Morlack carries off a girl againſt her will, or diſhonours her: and were ſuch attempts made, the young woman would, no doubt, be able to defend herſelf; the women in that country being generally very little leſs robuſt than the men. But the cuſtom is for the woman herſelf to appoint the time and place of being carried off; and ſhe does ſo in order to extricate herſelf from other ſuitors, from whom ſhe may have received ſome love-token, ſuch as a braſs ring, a little knife, or ſuch like trifles. The Morlack women keep themſelves ſomewhat neat till they get a huſband; but after marriage they abandon themſelves totally to a loathſome dirtineſs, as if they intended to juſtify the contempt with which they are treated. Indeed it cannot be ſaid that even the young women have a grateful odour, as they are uſed to anoint their hair with butter, which ſoon becoming rancid exhales no agreeable effluvia.

The dreſs of the unmarried women is the moſt complex and whimſical, in reſpect to the ornaments of the head; for when married they are not allowed to wear any thing elſe but a handkerchief, either white or coloured, tied about it. The girls uſe a ſcarlet cap, to which they commonly hang a veil falling down on the ſhoulders, as a mark of their virginity. The better ſort adorn their caps with ſtrings of ſilver coins, among which are frequently ſeen very ancient and valuable ones; they have moreover ear-rings of very curious work, and ſmall ſilver chains with the figures of half moons faſtened to the ends of them. But the poor are forced to content themſelves with plain caps; or if they have any ornaments, they conſiſt only of ſmall exotic ſhells, round glaſs beads, or bits of tin. The principal merit of theſe caps, which conſtitute the good taſte as well as vanity of the Morlack young ladies, is to attract and fix the eyes of all who are near them by the multitude of ornaments, and the noiſe they make on the leaſt motion of their heads. Hence half-moons of ſilver, or of tin, little chains and hearts, falſe ſtones and ſhells, together with all kind of ſplendid trumpery, are readily admitted into their head-dreſs. In ſome diſtricts, they fix tufts of various coloured feathers reſembling two horns on their caps; in

Morlachia. in others, tremulous plumes of glaſs; and in others, artificial flowers, which they purchaſe in the ſea-port towns; and in the variety of thoſe capricious and barbarous ornaments, ſometimes a fancy not inelegant is diſplayed. Their holiday-ſhifts are embroidered with red ſilk, and ſometimes with gold, which they work themſelves while they attend their flocks; and it is ſurpriſing to ſee how nicely this work is executed.—Both old and young women wear about their necks large ſtrings of round glaſs-beads, of various ſize and colour; and many rings of braſs, tin, or ſilver, on their fingers. Their bracelets are of leather covered with wrought tin or ſilver; and they embroider their ſtomachers, or adorn them with beads or ſhells. But the uſe of ſtays is unknown, nor do they put whalebone or iron in the ſtomacher. A broad woollen girdle ſurrounds their petticoat, which is commonly decked with ſhells, and of blue colour, and therefore called *modrina*. Their gown, as well as petticoat, is of a kind of ſerge; and both reach near to the ankle: the gown is bordered with ſcarlet, and called *ſadak*. They uſe no modrina in ſummer, and only wear the ſadak without ſleeves over a linen petticoat or ſhift.—The girls always wear red ſtockings; and their ſhoes are like thoſe of the men, called *opanke*. The ſole is of undreſſed ox-hide, and the upper part of ſheeps-ſkin thongs knotted, which they call *apute;* and theſe they faſten above the ankles, ſomething like the ancient cothurnus.

The unmarried women, even of the richeſt females, are not permitted to wear any other ſort of ſhoes; though after marriage they may, if they will, lay aſide the opanke, and uſe the Turkiſh ſlippers. The girls keep their hair treſſed under their caps, but when married they let it fall diſhevelled on the breaſt; ſometimes they tie it under the chin; and always have medals, beads, or bored coins, in the Tartar or American mode, twiſted amongſt it. An unmarried woman, who falls under the imputation of want of chaſtity, runs the riſk of having her red cap torn off her head publicly in church by the curate, and her hair cut by ſome relation, in token of infamy. Hence, if any of them happen to have fallen into an illicit amour, they commonly of their own accord lay aſide the badge of virginity, and remove into another part of the country.

Nothing is more common among the Morlacchi than marriages concluded between the old people of the reſpective families, eſpecially when the parties live at a great diſtance, and neither ſee nor know each other; and the ordinary motive of theſe alliances is the ambition of being related to a numerous and powerful family, famous for having produced valiant men. The father of the future bridegroom, or ſome other near relation of mature age, goes to aſk the young woman, or rather a young woman of ſuch a family, not having commonly any determinate choice. Upon this all the girls of the houſe are ſhown to him, and he chooſes which pleaſes him beſt, though generally reſpecting the right of ſeniority. A denial in ſuch caſes is very rare; nor does the father of the maid inquire much into the circumſtances of the family that aſks her. Sometimes a daughter of the maſter is given in marriage to the ſervant or tenant, as was uſual in patriarchal times; ſo little are the women regarded in this country. On theſe occaſions, however, the Morlacchi girls enjoy a privilege which ours would alſo wiſh to have, as in juſtice they certainly ought. For he who acts by proxy, having obtained his ſuit, is obliged to go and bring the bridegroom; and if, on ſeeing each other, the young people are reciprocally content, the marriage is concluded, but not otherwiſe. In ſome parts it is the cuſtom for the bride to go to ſee the houſe and family of the propoſed huſband, before ſhe gives a definitive anſwer; and if the place or perſons are diſagreeable to her, ſhe is at liberty to annul the contract. But if ſhe is contented, ſhe returns to her father's houſe, eſcorted by the bridegroom and neareſt relations. There the marriage day is appointed; on which the bridegroom comes to the bride's houſe, attended by all his friends of greateſt note, who on this occaſion are called *ſvati*, and are all armed, and on horſeback, in their holiday-cloaths, with a peacock's feather in their cap, which is the diſtinctive ornament uſed by thoſe who are invited to weddings. The company goes armed, to repulſe any attack or ambuſh that might be intended to diſturb the feaſt; for in old times theſe encounters were not unfrequent, according to the records of many national heroic ſongs.

The bride is conducted to a church veiled, and ſurrounded by the ſvati on horſeback; and the ſacred ceremony is performed amidſt the noiſe of muſkets, piſtols, barbaric ſhouts and acclamations, which continue till ſhe returns to her father's houſe, or to that of her huſband, if not far off. Each of the ſvati has his particular inſpection, as well during the cavalcade as at the marriage-feaſt, which begins immediately on their return from church. The parvinaz precedes all the reſt, ſinging ſuch ſongs as he thinks ſuitable to the occaſion. The bariactar brandiſhes a lance with a ſilken banner faſtened to it, and an apple ſtuck on the point; there are two bariactars, and ſometimes four, at the more noble marriages. The ſtari-ſvat is the principal perſonage of the brigade; and the moſt reſpectable relation is commonly inveſted with this dignity. The ſtacheo's duty is to receive and obey the orders of the ſtari-ſvat. The two diveri, who ought to be the bridegroom's brothers when he has any, are appointed to ſerve the bride. The knum correſponds to our ſponſors; and the komorgia, or ſekſana, is deputed to receive and guard the dowery. A ciaous carries the mace, and attends to the order of the march, as maſter of the ceremonies: he goes ſinging aloud, *Breberi*, *Davori*, *Dobraſrichia*, *Jara*, *Pico;* names of ancient propitious deities. Buklia is the cup-bearer of the company, as well on the march as at table; and all theſe offices are doubled, and ſometimes tripled, in proportion to the number of the company.

The firſt day's entertainment is ſometimes made at the bride's houſe, but generally at the bridegroom's, whither the ſvati haſten immediately after the nuptial benediction; and at the ſame time three or four men run on foot to tell the good news; the firſt who gets to the houſe has a kind of towel, embroidered at the ends, as a premium. The domachin, or head of the houſe, comes out to meet his daughter-in-law; and a child is handed to her, before ſhe alights, to careſs it; and if there happens to be none in the houſe, the child is borrowed from one of the neighbours. When ſhe

 alights,

Morlachia. alights, she kneels down, and kisses the threshold.—Then the mother-in-law, or in her place some other female relation, presents a corn-sieve, full of different kinds of grain, nuts, almonds, and other small fruit, which the bride scatters upon the svati, by handfuls, behind her back. The bride does not sit at the great table the first day, but has one apart for herself, the two diveri, and the stacheo. The bridegroom sits at table with the svati; but in all that day, consecrated to the matrimonial union, he must neither unloosen or cut any thing whatever. The knum carves his meat, and cuts his bread. It is the domachin's business to give the toasts; and the stari-svat is the first who pledges him. Generally the bukkara, a very large wooden cup, goes round, first to the saint protector of the family; next to the prosperity of the holy faith; and sometimes to a name the most sublime and venerable. The most extravagant abundance reigns at these feasts; and each of the svati contributes, by sending a share of provisions. The dinner begins with fruit and cheese; and the soup comes last, just contrary to our custom. All sorts of domestic fowls, kid, lamb, and sometimes venison, are heaped in prodigal quantities upon their tables; but very rarely a Morlacco eats veal, and perhaps never, unless he has been persuaded to do it out of his own country. This abhorrence to calves flesh is very ancient among the Morlacchi. St Jerom, against Jovinian, takes notice of it; and Tomeo Marnavich, a Bosnian writer, who lived in the beginning of the last age, says, that the Dalmatians, uncorrupted by the vices of strangers, abstained from eating calves flesh, as an unclean food, even to his days. The women relations, if they are invited, never dine at table with the men, it being an established custom for them to dine by themselves. After dinner, they pass the rest of the day in dancing, singing ancient songs, and in games of dexterity, or of wit and fancy; and in the evening, at a convenient hour after supper, the three ritual healths having first gone round, the knum accompanies the bridegroom to the matrimonial apartment, which commonly is the cellar or the stable, whither the bride is also conducted by the diveri and the stacheo; but the three last are obliged to retire, and the knum remains alone with the new-married couple. If there happens to be any bed pregared better than straw, he leads them to it: and having untied the bride's girdle, he causes them both to undress each other reciprocally. It is not long since the knum was obliged to undress the bride entirely; but that custom is now out of use; and, instead of it, he has the privilege of kissing her as often as he pleases, wherever he meets her; which privilege may possibly be agreeable for the first months, but must soon become very disgustful. When they are both undressed, the knum retires, and stands listening at the door, if there be a door. It is his business to announce the consummation of the marriage, which he does by discharging a pistol, and is answered by many of the company. The next day the bride, without her veil and virginal cap, dines at table with the svati, and is forced to hear the coarse equivocal jests of her indelicate and sometimes intoxicated company.

These nuptial-feasts, called *sdrave* by the ancient Huns, are by our Morlacchi called *sdravize*, from whence our Italian word *stravizzo* is undoubtedly derived. They continue three, six, eight, or more days, according to the ability or prodigal disposition of the family where they are held. The new-married wife gets no inconsiderable profit in these days of joy; and it usually amounts to much more than all the portion she brings with her, which often consists of nothing but her own cloaths and perhaps a cow; nay, it happens sometimes that the parents, instead of giving money with their daughter, get something from the bridegroom by way of price. The bride carries water every morning, to wash the hands of her guests as long as the feasting lasts; and each of them throws a small piece of money into the bason after performing that function, which is a very rare one among them, excepting on such occasions. The brides are also permitted to raise other little contributions among the svati, by hiding their shoes, caps, knives, or some other necessary part of their equipage, which they are obliged to ransom by a piece of money, according as the company rates it. And, besides all these voluntary or extorted contributions already mentioned, each guest must give some present to the new married wife at taking leave the last day of the sdravise; and then she also distributes some trifles in return, which commonly consist in shirts, caps, handkerchiefs, and such like.

The nuptial-rites are almost precisely the same thro' all the vast country inhabited by the Morlacchi; and those in use among the peasants and common people of the sea-coast of Dalmatia, Istria, and the islands, differ but little from them. Yet among these particular varieties, there is one of the island Zlarine, near Sebenico, remarkable enough; for there the starisvat (who may naturally be supposed drunk at that hour) must, at one blow with his naked broad sword, strike the bride's crown of flowers off her head, when she is ready to go to bed. And in the island of Pago, in the village of Novoglia (probably the Gissa of ancient geographers), there is a custom more comical, and less dangerous, but equally savage and brutal. After the marriage-contract is settled, and the bridegroom comes to conduct his bride to church, her father or mother, in delivering her over to him, makes an exaggerated enumeration of her ill qualities: "Know, since thou wilt have her, that she is good for nothing, ill-natured, obstinate, &c." On which the bridegroom, affecting an angry look, turns to the young woman, with an "Ah! since it is so, I will teach you to behave better;" and at the same time regales her with a blow or a kick, or some piece of similar gallantry, which is by no means figurative. And it seems in general, that the Morlack women, and perhaps the greatest part of the Dalmatians, the inhabitants of the cities excepted, do not dislike a beating either from their husbands or lovers.

In the neighbourhood of Dernish, the women are obliged, during the first year after marriage, to kiss all their national acquaintances who come to the house; but after the first year they are dispensed from that compliment; and indeed they become so intolerably nasty, that they are no longer fit to practise it. Perhaps the mortifying manner in which they are treated by their husbands and relations is, at the same time, both

Morlachia, Morley. both the caufe and effect of their fhameful neglect of their perfons. When a Morlack hufband mentions his wife, he always premifes, by your leave, or begging your pardon. And when the hufband has a bedftead, the wife muft fleep on the floor near it. Our author often lodged in Morlack houfes, and obferved that the female fex is univerfally treated with contempt: it is true, that the women are by no means amiable in that country; they even deform and fpoil the gifts of nature.

The pregnancy and births of thofe women would be thought very extraordinary among us, where the ladies fuffer fo much, notwithftanding all the care and circumfpection ufed before and after labour. On the contrary, a Morlack woman neither changes her food nor interrupts her daily fatigue on account of her pregnancy; and is frequently delivered in the fields, or on the road, by herfelf; and takes the infant, wafhes it in the firft water fhe finds, carries it home, and returns the day after to her ufual labour, or to feed her flock.

The little creatures, thus carelefsly treated in their tendereft moments, are afterwards wrapt in miferable rags, where they remain three or four months, under the fame ungentle management; and when that term is elapfed, they are fet at liberty, and left to crawl about the cottage and before the door, till they learn to walk upright by themfelves; and at the fame time acquire that fingular degree of ftrength and health with which the Morlacchi are endowed, and are able, without the leaft inconvenience, to expofe their naked breafts to the fevereft frofts and fnow. The infants are allowed to fuck their mother's milk while fhe has any, or till fhe is with child again; and if that fhould not happen for three, four, or fix years, they continue all that time to receive nourifhment from the breaft. The prodigious length of the breafts of the Morlacchian women is fomewhat extraordinary; for it is very certain, that they can give the teat to their children over their fhoulders, or under their arms. They let the boys run about, without breeches, in a fhirt that reaches only to the knee, till the age of 13 or 14, following the cuftom of Boffina, fubject to the Porte, where no haraz or capitation-tax is paid for the boys till they wear breeches, they being confidered before that time as children, not capable of labouring, or of earning their bread. On the occafion of births, and efpecially of the firft, all the relations and friends fend prefents of eatables to the woman in childbed, or rather to the woman delivered; and the family makes a fupper of all thofe prefents together. The women do not enter the church till 40 days after child-birth.

The Morlacchi pafs their youth in the woods, attending their flocks and herds; and in that life of quiet and leifure they often become dexterous in carving with a fimple knife: they make wooden cups, and whiftles adorned with fanciful baffe-reliefs, which are not void of merit, and at leaft fhow the genius of the people.

MORLEY (George), bifhop of Winchefter, was the fon of Francis Morley, Efq; and was born at London in 1597. He was educated at Chrift-church, Oxford, of which he had the canonry in 1641, and the next year was made doctor of divinity. He had alfo feveral church-preferments, of which he was deprived by the parliament vifitors in the beginning of the year 1648. After this, king Charles I. fent for him to affift at the treaty of the Ifle of Wight. After the king's death he attended the lord Capel at his execution, and then retired to Charles II. at the Hague, on whom he conftantly waited till his majefty went to Scotland, when he retired to Atwerp, where he read the fervice of the church of England, as he afterwards did at Breda. At the Reftoration he was firft made dean of Chrift church, and in 1660 was confecrated bifhop of Worcefter, and foon after was made dean of the royal chapel. In 1662 he was tranflated to the bifhopric of Winchefter, when he beftowed confiderable fums on that fee, in repairing Farnham-caftle and his palace at Weftminfter, and in purchafing Winchefter houfe at Chelfea. He died at Farnham-caftle in 1684. He was a Calvinift, and before the wars was thought a friend to the Puritans; but after his promotion he took care to free himfelf from all fufpicions of that kind. He was a pious and charitable man, of a very exemplary life, but extremely paffionate. He publifhed, 1. *Epiftola apologetica et parænetica ad theologum quendam Belgam fcripta*, in 4to. 2. The fum of a fhort conference between Father Darcey a Jefuit and Dr Morley at Bruffels. 3. An argument drawn from the evidence and certainty of fenfe againft the doctrine of Tranfubftantiation. 4. A letter to Anne duchefs of York. 5. Several fermons, and other pieces.

Mornay. MORNAY (Philippe de), feigneur du Pleffis-Marly, was born at Buhy or Bifhuy in Upper Normandy, November 5th, 1549, and educated at Paris. What was then thought a prodigy in a gentleman, he made a rapid progrefs in the belles lettres, in the learned languages, and in theology. He was at firft deftined for the church; but the principles of Calvinifm, which he had imbibed from his mother, effectually excluded him from the ecclefiaftical preferments to which he was entitled by his intereft, abilities, and birth. After the horrible maffacre of St Bartholomew, Philippe de Mornay made the tour of Italy, Germany, England, and the Low Countries; and he was equally improved and delighted by his travels. Mornay afterwards joined the king of Navarre, at that time leader of the Proteftant party, and fo well known fince by the name of Henry IV. This prince fent Mornay, who employed his whole abilities, both as a foldier and a writer, in defence of the Proteftant caufe, to conduct a negociation with Elifabeth queen of England; and left him wholly to his own difcretion in the management of that bufinefs. He was fuccefsful in almoft every negociation, becaufe he conducted them like an able politician, and not with a fpirit of intrigue. He tenderly loved Henry IV. and fpoke to him on all occafions as to a friend. When he was wounded at Aumale, he wrote to him in thefe words: "Sire, you have long enough acted the part of Alexander, it is now time you fhould act that of Cæfar. It is our duty to die for your majefty, &c. It is glorious for you, Sire, and I dare venture to tell you it is your duty, to live for us." This faithful fubject did every thing in his power to raife Henry to the throne. But when he deferted the Proteftant faith, he reproached him in the bittereft manner, and retired

Mornay. retired from court. Henry ftill loved him; and was extremely affected with an infult which he received in 1597 from one Saint-Phal, who beat him with a cudgel, and left him for dead. Mornay demanded juftice from the king; who gave him the following anfwer, a proof as well of his fpirit as of his goodnefs of heart. "Monfieur Dupleffis, I am exceedingly offended at the infult you have received; and I fympathize with you both as your fovereign and your friend. In the former capacity, I fhall do juftice to you and to myfelf; and had I fuftained only the character of your friend, there are few perhaps who would have drawn their fword or facrificed their life more cheerfully in your caufe. Be fatisfied, then, that I will act the part of a king, a mafter, and a friend, &c." Mornay's knowledge, probity, and valour, made him the foul of the Proteftant party, and procured him the contemptuous appellation of the *Pope of the Huguenots*. He defended their doctrines both by fpeech and writing. One of his books on the Iniquity of the Mafs, having ftirred up all the Catholic divines, he refufed to make any reply to their cenfures and criticifms except in a public conference. This was accordingly appointed to be held A. D. 1600, at Fountainbleau, where the court then was. The two champions were, du Perron bifhop of Evreux, and Mornay. After a great many arguments and replies on both fides, the victory was adjuged to du Perron. He had boafted that he would point out to the fatisfaction of every one five hundred errors in his adverfary's book, and he partly kept his word. The Calvinifts did not fail to claim the victory on this occafion, and they ftill continue to do fo. This conference, inftead of putting an end to the differences, was productive of new quarrels among the controverfialifts, and of much profane wit among the libertines. A Huguenot minifter, who was prefent at the conference, obferved with great concern to a captain of the fame party,—"The bifhop of Evreux has already driven Mornay from feveral ftrong holds." "No matter (replied the foldier), provided he does not drive him from Saumur." This was an important place on the river Loire, of which Dupleffis was governor. Hither he retired, his attention being conftantly occupied in defending the Huguenots, and in making himfelf formidable to the Catholics. When Louis XIII. was making preparations againft the Proteftants, Dupleffis wrote him a letter, diffuading him againft fuch a meafure. After employing the moft plaufible arguments, he concludes in the following manner: "To make war on the fubject, is an indication of weaknefs in the government. Authority confifts in the quiet fubmiffion of the people, and is eftablifhed by the prudence and juftice of the governor. Force of arms ought never to be employed except in repelling a foreign enemy. The late king would have fent the new minifters of ftate to learn the firft elements of politics, who like unfkilful furgeons would apply violent remedies to every difeafe, and advife a man to cut off an arm when his finger aches." Thefe remonftrances produced no other effect than the lofs of the government of Saumur, of which he was deprived by Louis XIII. in 1621. He died two years after, November 11th, 1623, aged 74, in his barony *de la Foret-fur-Seure* in Poitou. The Proteftant caufe never had an abler fupporter or one who did it more credit by his virtues and abilities.

Cenfeur des courtifans, mais à la cour aimé;
Fier ennemi de Rome, et de Rome eftimé. HENRIADE.

The following is a lift of his works: 1. *Un Traité de l'Euchariftie*, 1604, in folio. 2. *Un Traité de la verité de la Religion Chretienne*, 8vo. 3. A book entitled *La Myftere d'iniquité*, 4to. 4. *Un difcours fur le droit pretendu par ceux de la maifon de Guife*, 8vo. 5. Curious and interefting *Memoirs* from the year 1572 to 1629, 4 vols 4to, valuable. 6. *Letters*; which are written with great fpirit and good fenfe. David des Liques has given us his life in quarto; a book more interefting for the matter than the manner.

Morne-garou. MORNE-GAROU, a very remarkable volcanic mountain on the ifland of St Vincent's in the Weft Indies. It was vifited by Mr James Anderfon furgeon in the year 1784, who is the only perfon that ever afcended to the top of it, and from whofe account, in the Philofophical Tranfactions, Vol. LXXV. the following is taken.

The mountain in queftion is fituated on the northweft part of the ifland, and is the higheft in it. It is conftantly reported to have emitted volcanic eruptions; and the ravins at the bottom feem to corroborate the traditions of the inhabitants in this refpect. The ftructure of it, when viewed at a diftance, appears different from that of any other mountain in the ifland, or that Mr Anderfon had feen in the Weft Indies. He could perceive it divided into many different ridges, feparated by deep chafms, and its fummit appeared quite deftitute of every vegetable production. Several ravins, that run from the bottom a great way up the mountain, were found quite deftitute of water, and pieces of pumice-ftone, charcoal, and feveral earths and minerals of a particular quality, found in them, plainly indicated fome very great fingularity in this mountain. Some very old men alfo informed our author, that they had heard it related by the captain of a fhip, that between this ifland and St Lucia he faw flames and fmoke rifing from the top of the mountain, and next morning his decks were covered with afhes and fmall ftones.

Mr Anderfon's curiofity was fo much excited by thefe circumftances, that he formed a refolution of going up to the top; but was informed that this was impoffible, nor could he find either white man, Caribbee, or negro, who would undertake to fhow him the way. Having obferved the bafis as well as he could, with a view to difcover the moft proper place for attempting an afcent, he found feveral dry ravins that feemingly ran a great way up, though he could not be certain that they were not interfected by rocks or precipices lying acrofs. Having examined the mountain with a good glafs, he thought he perceived two ridges by which there was a poffibility of getting up; and though they appeared to be covered for a great way with wood, he hoped by a little cutting to open a way through it.

On the 26th of February 1784 our author began his journey, having been furnifhed by a Mr Maloune, who lives within a mile of the foot of the mountain, with two ftout negroes, and having another boy who waited on himfelf. They arrived at the bottom of the

Morne-garou.

the mountain a little before seven in the morning, having each a good cutlafs to cut through the woods, or to defend themfelves in cafe of an attack from the Caribbees or runaway negroes. Before they could get at either of the ridges, however, they had a rock to climb upwards of 40 feet high. Having fcrambled up this with great difficulty, they found themfelves in the bottom of a deep and narrow ravin, which having afcended a little way, they arrived at the habitation of Mr Gafco a Frenchman. Mr Anderfon expreffes his furprife, that a young and healthy man, and a good mechanic, fhould fequeftrate himfelf from the world among woods and precipices, where he was befides in continual danger of being fwept away with his whole habitation by the torrents occafioned by the rains. He found him, however, an intelligent man, and was hofpitably entertained by him.

"The difficulty (fays Mr Anderfon) in going thro' woods in the Weft Indies, where there are no roads or paths, is far beyond any thing an European can conceive. Befides tall trees and thick underwood, there are hundreds of different climbing plants twifted together like ropes, and running together in all directions to a great extent, and even to the tops of the higheft trees. They cannot be broken by pufhing on; and many of them are not to be cut without difficulty. Befides thefe, a fpecies of grafs, the *fchœnus lithofpermos*, with ferrated leaves, cuts and tears the hands and face terribly."

By reafon of thefe obftructions, it was upwards of two hours before they got upon the ridge; but here they found their paffage more difficult than before. They were now furrounded by a thick foreft, rendered more impracticable by the large piles of trees blown down by the hurricanes; which obliged them in many places to creep on their hands and feet to get below them, while in others it was neceffary to climb to a confiderable height to get over them; at the fame time that by the trunks being frequently rotten, they often tumbled headlong from a great height, and could not extricate themfelves without great difficulty.

The fatigue of cutting their way through the woods foon became intolerable to the negroes; fo that about four in the afternoon he could not prevail on them to go any farther. Mr Anderfon therefore perceiving it was impoffible to get to the fummit that night, and his water being totally expended, returned to Mr Gafco's, where he fpent the night, determining to try another route next morning. The hofpitable Frenchman entertained him in the beft manner he could; but though he parted with his own hammock to him, and flept on a board himfelf, Mr Anderfon found it impoffible to fhut his eyes the whole night by reafon of the cold. "His hut (fays he) was built of *rofeaux* or large reeds, between each two of which a dog might creep through, and the top was covered with dry grafs. It is fituated in the bottom of a deep gully, where the fun does not fhine till nine in the morning nor after four in the afternoon. It is furrounded by thick wood; and during the night the whole of the mountain is covered with thick clouds, from which it frequently rains, and which makes the night-air exceedingly cold."

Early next morning Mr Anderfon fet out in company with the negro boy, who continued very faithful to him during the whole of the journey. He now determined to take his courfe up the ravin, and proceeded for about a mile and an half without any confiderable obftruction. It now, however, began to narrow faft: there were numbers of rocks and precipices to climb over, with many bufhes and vines which could fcarcely be got through. At laft the ravin terminated at the bottom of a very high precipice. It was impoffible to know the extent of this, as the top was covered with thick wood; but from the bottom upward, as far as he could fee, was loofe fand with ferns and tufts of grafs, which as foon as he took hold of them came up by the roots. Though the afcent was plainly at the rifk of his life, Mr Anderfon refolved to attempt it; and therefore telling the boy to keep at fome diftance behind, left he fhould tumble and drive him down, he began to afcend, digging holes with his cutlafs to put his feet in, and taking hold of the tufts of grafs as lightly as poffible. Notwithftanding all his care, however, he frequently flipped down a confiderable way; but as it was only loofe fand, he could eafily pufh his cutlafs into it up to the handle, and thus by taking hold of it recover himfelf again. At laft he got up to fome wild plantains, which continued all the way to the place where the trees began to grow. Here he refted for fome time, waiting for the boy, who got up with much lefs difficulty than he had done. On getting up to the top of the precipice, he found himfelf on a very narrow ridge, covered with wood, and bounded by two ravins, the bottoms of which he could not fee, the defcent to them appearing to be nearly perpendicular, though all the way covered with thick wood. Proceeding onwards, they found the ridge exceedingly narrow, in many places not fix feet broad; with a tremendous gulf on each fide, into which they were every moment in danger of falling; fo that Mr Anderfon was obliged to lie down on his belly with great caution, in order to fee through the bufhes how the ridge tended.

Here a fulphureous fmell, or rather one like gunpowder, began to be perceived; which, Mr Anderfon knew, muft proceed from the top of the mountain, as the wind then blew that way; and as it plainly grew ftronger as he advanced, he was in hopes that the top could not be very far diftant. Perceiving a rifing before him, he imagined, that, by getting upon it, he might have a view of the top of the mountain; but when this was done, he could only fee a peak on the north-weft fide of the mountain, to which, by appearance, he judged himfelf very little nearer than when at the bottom.

The woods now became very difficult, great quantities of fallen trees lying buried among the grafs; and being rotten, he was frequently buried very deep among them when he thought himfelf walking upon firm ground. About noon he was alarmed with a ruftling among the bufhes, and fomething like a human voice behind him; but as he was preparing to defend himfelf againft Carribbees or run-away negroes, he was agreeably furprifed with the fight of thofe who had formerly left him, with three others, fent by Mr Maloune with plenty of provifions. Encouraged by this affiftance, after refrefhing themfelves, they renewed their labours with frefh vigour, and Mr Anderfon thought himfelf fure of reaching the top before night.

In-

Morne-garou.

In a little time he had a fair view of the ravin on the left, which was of prodigious depth, and ran from near the top of the mountain to the fea. Its bottom feemed to be a rock nearly refembling lava in colour, and it feemed as if there had been vaft torrents of fulphureous matter running upon it for fome time.—He now regretted much that he knew not of this ravin before he commenced his excurfion, as, by paffing a headland in a canoe, and getting into it, he might have gained the fummit without all thofe delays and difficulties he had encountered.

About four in the afternoon he had no profpect of the top of the mountain, but imagined that if he could get into the ravine before night, he might eafily reach it next morning. After cutting through wild plantains for a great way, however, he found himfelf at funfet on the brink of a precipice, over which he prevented himfelf from falling by catching hold of fome fhrubs. They were now about half way down, but all the reft of the way feemed a perpendicular precipice, which it was impoffible to pafs; the top of the mountain was yet a great way off, and there was no other refource than to attempt the ridge they had left. The evening was now fo far advanced, that they were obliged to take up their refidence where they were; and there was only time to place two or three fticks againft the ftump of a tree, and flightly to cover them with plantain leaves for a night's habitation. —Their fituation, however, was extremely uncomfortable: it began to rain and blow violently, which prevented them from getting a fire made, fo that they were almoft chilled with cold. As foon as they could fee, they renewed their work with great alacrity, and in a fhort time had the fatisfaction to perceive that the woods became thin. About eleven o'clock they obtained a full view of the top, about a mile diftant. It feemed to be compofed of fix or feven ridges, very much broken in the fides, as if they had fuffered great convulfions; and they were divided by exceffively deep ravins without any water in them. Mr Anderfon directed his courfe towards a high peak that overlooked a large excavation where the ridges met, and which he fuppofed to be the crater of the volcano. In his way, he found the laft wood compofed of a moft beautiful fpecies of trees. After that he entered into a thick long grafs intermixed with fern, which branched and ran in every direction. Thro' this they were obliged to cut their way with almoft as much difficulty as they had done through the woods, and it feemed to continue very near to the top of the mountain. The fatigue of this work foon reduced them to fuch a fituation, that they were fcarce able to ftand; and they were obliged to quench their thirft, which was exceffive, by chewing the leaves of the begonia obliqua, there being no water to be had in the place. Two of the negroes returned, and the reft refufed to proceed any farther; fo that Mr Anderfon himfelf was obliged to abandon the enterprife, and they all began to defcend about half an hour after twelve; and as there was now a clear path all the way down, they arrived at Mr Gafco's by funfet; and notwithftanding his extreme wearinefs, Mr Anderfon continued his journey to Mr Maloune's, where he arrived between fix and feven at night.

Our traveller having refrefhed himfelf to the 4th of March, in order to fuftain the fatigues of his journey the better, fet out about four that morning in company with a Mr Frafer, who had refolved to accompany him. They met with little difficulty till they came to the place whence they had formerly returned. Here, however, they were obliged for a quarter of a mile to cut their way through the grafs and ferns already mentioned; which being done, they met with no further obftruction. When they came within a quarter of a mile of the top, they found the climate fuddenly altered, the air very cold, and the vegetable productions changed, the whole fummit of the mountain being barren. On the confines of the graffy and barren regions, however, he found fome beautiful plants; and he obferves, that this is the only place in the Weft Indies where he ever found mofs: but here it grows in fuch plenty, that he frequently funk in it up to the knees. About noon they reached the fummit, and were inftantly furprifed with the fight of a moft extraordinary cavity. It is fituated in the very centre of the mountain, at the place where all the ridges meet. Its diameter is fomething more than a mile, and its circumference to appearance a perfect circle. Its depth from the furrounding margin is above a quarter of a mile, and it narrows a little, but very regularly, to the bottom. Its fides are very fmooth, and for the moft part covered with fhort mofs, except towards the fouth, where there are a number of fmall holes and rents. This is the only place where it is poffible to go down to the bottom; and the defcent is very dangerous on account of the numberlefs fmall chafms. On the weft fide is a fection of a red rock like granite, cut very fmooth, and having the fame declivity with the other parts. All the reft of the furrounding fides feem to be compofed of fand, which has undergone the action of an intenfe fire. It has a cruft quite fmooth, and about an inch thick, almoft as hard as rock; on breaking thro' which we meet with nothing but loofe fand. In the centre ftands a burning mountain about a mile in circumference, of a conic form, " but quite level." Out of the middle of the fummit rifes a fmall eminence eight or ten feet high, and perfectly conical; from the apex of which a column of fmoke conftantly iffues. It is compofed of large maffes of red granite-like rock, of various fhapes and fizes, which appear to have been fplit into their prefent form by fome terrible convulfion of nature; and are piled up very regular. Great quantities of fmoke iffue from moft parts of the mountain, efpecially on the north fide, which appears to be burning from top to bottom; and the heat is fo intenfe, that it is impoffible to afcend it. It is even very dangerous to go round the bafe, as large maffes of rock are conftantly fplitting with the heat and tumbling down. At the bottom, on the north fide, is a very large rock fplit in two. Each of thefe halves, which are rent in all directions, are feparated to a confiderable diftance from each other, and the crevices have gloffy efflorefcences tafting like vitriol. There are alfo beautiful cryftallizations of fulphur; and on all parts of the mountain are great quantities of fulphur, alfo, alum, vitriol, &c.

From the external appearance of this mountain, Mr Anderfon conjectures that it had but lately begun to burn; as on feveral parts of it he faw fmall fhrubs and

and grafs, which looked as if they had been but lately fcorched and burnt. There were alfo feveral holes on the fouth from which fmoke iffued, that appeared to have broken out but lately, the adjacent bufhes being but lately burnt. On two oppofite fides, the eaft and weft, of the burning mountain, are two lakes of water, about a ftone's throw in breadth. They appear to be deep in the middle, and have a bottom of a kind of clay. The water is a chalybeate, and has a pleafant tafte. Thefe lakes probably derive their exiftence in a great meafure, if not totally, from the rain-water running down the fides of the crater. On the north fide Mr Anderfon obferved the traces of great torrents, that to appearance had conveyed vaft quantities of water to thefe lakes; and by the ftones at the bottom he could perceive that abforption or evaporation, or both, went on very faft. The greater part of the bottom of the crater is very level; and on the fouth fide are fome fhrubs and fmall trees. Some pieces of pumice-ftone were met with, and many ftones about the fize of a man's fift, rough, and blue upon one fide, are fcattered all over the mountain.

The motion of the clouds on the top of this mountain was very fingular. Though there were feveral parts higher than the crater, yet the clouds feemed always to be attracted by the latter. After entering on its eaft or windward fide, they funk a confiderable way into it; then mounting the oppofite fide, and whirling round the north-weft fide, they ran along a ridge which tended nearly north-eaft, and afterwards funk into a deep ravin dividing this ridge from another on the north-weft corner of the mountain, and the higheft on it, lying in a direction nearly north and fouth. They keep in this ridge to the fouth end, and then whirl off in their natural direction.

From the fituation of thefe iflands to one another, and to the continent of South America, Mr Anderfon conjectures, that there are fubmarine communications between the volcanoes in each of them, and from them to thofe in the high mountains of South America. He obferves, that the crater in this ifland lies nearly in a line with Soufriere in St Lucia and Morne Pelee in Martinico; and probably from thence to a place of the fame kind in Dominique, and from thence to the other iflands; there being fomething of the kind in each, Barbadoes and Tobago excepted.

MOROC, or Maroc, a beautiful bird of Abyffinia defcribed by Mr Bruce, who thinks its name is derived from *mar* "honey," though he fays that he never heard it was further concerned in the honey than deftroying bees. It feems to purfue thofe infects out of enmity or diverfion as well as for food, leaving great numbers dead on the ground, befides thofe which it devours for food. In confequence of this property, the maroc is never found any where but in thofe parts where the honey is very plentiful, tho' the Abyffinians never take any notice of the ravages they commit among their ftocks of bees.

The moroc refembles the cuckoo in fize and fhape, but differs in other refpects. Its mouth is very wide, the opening reaching almoft to his eyes; the infide of the mouth and throat yellow, the tongue fharp-pointed, and capable of being drawn almoft half its length out of the mouth beyond the point of its beak, and is very flexible. The head and neck are brown, without any mixture of other colours: there are likewife a number of very fmall and fcarcely vifible hairs at the root of the beak. The eyebrows are black; the beak pointed, and very little crooked; the pupil of the eye black, and furrounded with an iris of a dull and dufky red: The fore-part of the neck is light yellow, darker on each fide than in the middle, where it is partly white: the yellow on each fide reaches near the fhoulder, or round part of the wing; and from this the whole breaft and belly is of a dirty white to the under part of the tail; and from this the feathers begin to be tipt with white, as are all thofe that cover the outfide of the wing. The wing has eight feathers of the largeft fize and fix of the fecond: the tail confifts of twelve feathers, the longeft three being in the middle: they are placed clofely together; and the tail is of an equal breadth from top to bottom, the feathers being alfo tipt with white. The thighs are covered with feathers of the fame colour as thofe of the belly, reaching more than half way down the legs, which are black, as well as the feet, and marked diftinctly with fcales. There are two toes before and behind, each of which has a fharp and crooked claw. It makes a fharp fnapping noife when it catches the bees, evidently from clofing its beak; but Mr Bruce never could difcover that it had any fong.

This feems to be the creature mentioned by Dr Sparman under the name of *cuculus indicator*, which (he fays) has the fingular property of difcovering the nefts of wild bees, and leading travellers by a certain cry to the place where the treafure is depofited. According to Sparman's account, it makes known thefe difcoveries by the fame cry to foxes as well as to the human fpecies; but Jerome Lobo, who mentions the Abyffinian bird, does not take notice of the foxes, though he mentions its finging melodioufly when it arrives at the place where the honey is depofited. Both thefe accounts are feverely criticifed by Mr Bruce. "I cannot (fays he), for my own part, conceive, in a country where there are fo many thoufand hives, that there was any ufe for giving to a bird a peculiar inftinct or faculty of difcovering honey, when, at the fame time, nature had deprived him of the power of availing himfelf of any advantage from the difcovery; for man feems in this cafe to be made for the fervice of the moroc, which is very different from the common and ordinary courfe of things; man certainly needs him not, for on every tree, and on every hillock, he may fee plenty of honey at his own deliberate difpofal. I cannot then but think, with all fubmiffion to thefe natural philofophers, that the whole of this is an improbable fiction; nor did I ever hear a fingle perfon in Abyffinia fuggeft, that either this or any other bird had fuch a property. Sparman fays it was not known to any inhabitant of the Cape, any more than that of the moroc was in Abyffinia; it was a fecret of nature, hid from all but thefe two great men; and I moft willingly leave it among the catalogue of their particular difcoveries."

MORNING, the beginning of the day, or the time of the fun-rifing. The aftronomers reckon morning, *mane*, from the time of midnight to that of midday. Thus an eclipfe is faid to begin at 11 o'clock in the morning, &c.

Morning ftar, is the planet Venus, when a little to

Morocco. to the weftward of the fun; that is, when fhe rifes a little before. In this fituation fhe is called by the Greeks *Phofphorus*; by the Latins *Lucifer*, &c.

1 Situation and boundaries. MOROCCO, an empire of Africa, comprehending a confiderable part of the ancient Mauritania, is bounded on the weft by the Atlantic Ocean; on the eaft by the river Mulvya, which feparates it from Algiers; on the north by the Mediterranean; and on the fouth by mount Atlas, or rather by the river Sus, which divides it from the kingdom of Tafilet. Its greateft length is from the north-eaft to the fouth-weft, amounting to above 590 miles; its breadth is not above 260 where broadeft, and in the moft narrow places is not above half that breadth.

2 Hiftory. The ancient hiftory of Morocco has been already given under the article MAURITANIA. It continued under the dominion of the Romans upwards of 400 years. On the decline of that empire it fell under the Goths, who held it till about the year 600, when the Goths were driven out by the Vandals, the Vandals by the Greeks, and they in their turn by the Saracens, who conquered not only this empire, but we may fay the whole continent of Africa; at leaft their religion, one way or other, is to be found in all parts of it. The Saracen empire did not continue long united under one head, and many princes fet up for themfelves in Africa as well as elfewhere, through whofe diffenfions the Almoravides were at length raifed to the fovereignty, as related under the article ALGIERS, n° 2. Yufef, or Jofeph, the fecond monarch of that line, built the city of Morocco, conquered the kingdom of Fez, and the Moorifh dominions in Spain; all which were loft by his grandfon Abbu Hali, who was defeated and killed by the Spaniards. On this prince's death the crown paffed to the Mohedians, or Almohedes, with whom it had not continued above three generations, when Mohammed the fon of Al Manfur loft the famous battle of Sierra Morena, in which 200,000 Moors were flain, and in confequence of which Alphonfo X. retook a great many of the Moorifh conquefts immediately after.

Mohammed died foon after this difgrace, and left feveral fons, between whom a civil war enfued, during which the viceroys of Fez, Tunis, and Tremefen, found means to eftablifh themfelves as independent princes. At length one of the princes of the royal blood of Tremefen having defeated the Almohedes, made himfelf mafter of the kingdoms of Morocco and Fez, and entailed them on his own family. In a fhort time, however, this family was expelled by the Merini, the Merini by the Oatazes, and thefe by the Sharifs of Hafcen, who have kept the government ever fince.

This happened about the year 1516; and fince that time, what we have under the name of hiftory is little elfe than a catalogue of the enormous vices and exceffes of the emperors. They have been in general a fet of bloody tyrants; though they have had among them fome able princes, particularly Muley Moluc, who defeated and killed Don Sebaftian king of Portugal. See the article PORTUGAL, n° 26. They have lived in almoft a continual ftate of warfare with the kings of Spain and other Chriftian princes ever fince; nor does the crown of Great Britain fometimes difdain, as in the year 1769, to purchafe their friendfhip with prefents.

Nothing can be conceived more unjuft and defpotic than the government of Morocco, and nothing more degenerate than the character of the people. The emperor is allowed to have not only an uncontrolable power over the lives and fortunes of his fubjects, but in a great meafure over their confciences, fuch as they are; in as much as he is the only perfon who, as the fucceffor of the prophet, has a right to interpret the Koran; and appoints all the judges under him, of whom thofe of Morocco and Fez are the chief, whofe bufinefs it is to explain and difpenfe all matters relating to their religion; and who, being his creatures and dependents, dare not fteer otherwife than as he directs. Whenever therefore the laws are enacted by him, and proclaimed by his governors in all the provinces, as is commonly done, that none may plead ignorance, they are everywhere received with an implicit and religious fubmiffion. On the other hand, the fubjects are bred up with a notion, that thofe who die in the execution of his command are entitled to an immediate admittance into paradife, and thofe who have the honour to die by his hand to a ftill greater degree of happinefs in it. After this we need not wonder at finding fo much cruelty, oppreffion, and tyranny on the one fide, and fo much fubmiffion, paffivenefs, and mifery on the other. 3 Government.

This latter, however, extends no farther than the Moors: for as to the mountaineers, the fubjection and tribute they pay to thofe tyrants was always involuntary, and altogether forced; and as for the negroes, their zeal and attachment is owing merely to the great fway and power which they have gained in the government, on various accounts. They were firft introduced, or rather their importation increafed, by the policy of Muley Ifhmael, a late emperor, at a period when there was a great decreafe of population in the empire, occafioned in fome degree by the enormous cruelties exercifed by its former fovereigns, who have been known not unfrequently, through a flight difguft, to abandon a whole town or province to the fword. In the character of Muley Ifhmael were found the moft fingular inconfiftencies; for it is certain, that although a tyrant of the fame clafs, yet in other refpects, as if to repair the mifchief which he committed, he left nothing undone for the encouragement of population.—He introduced, as above-mentioned, large colonies of negroes from Guinea; built towns for them, many of which are ftill remaining; affigned them portions of land, and encouraged their increafe by every poffible means. He foon initiated them in the Mahometan faith; and had his plan been followed, the country by this time would have been populous, and probably flourifhing. As the negroes are of a more lively, active, and enterprifing difpofition than the Moors, they might foon have been taught the arts of agriculture; and their fingular ingenuity might have been directed to other ufeful purpofes. It is true, Muley Ifhmael, when he adopted this plan, had more objects in view than that of merely peopling his dominions. He faw plainly that his own fubjects were of too capricious a difpofition to form foldiers calculated for his tyrannical purpofes. They had uniformly manifefted an inclination to change their fovereigns, though more from the love of variety than to reform the government, or reftrain the abufes of tyranny. In fhort, whatever revolutions 4 Account of the black troops.

revolutions took place in the country, conſiſted merely in a change of one tyrant for another. Muley Iſhmael had diſcernment enough to ſee, therefore, that by forming an army of ſlaves, whoſe ſole dependence ſhould reſt upon their maſter, he could eaſily train them in ſuch a manner as to act in the ſtricteſt conformity to his wiſhes. He ſoon learnt that the great object with the negroes was plenty of money and liberty of plunder; in theſe he liberally indulged them, and the plan fully anſwered his expectations. Though, however, Muley Iſhmael had no great merit in introducing ſubjects for the purpoſes of tyranny, yet the good effects of this new colonization were very generally experienced. By intermarrying among themſelves, and intermixing among the Moors (for the Moors will keep negro women as concubines, though they ſeldom marry them), a new race of people ſtarted up, who became as uſeful ſubjects as the native inhabitants, and brought the empire into a much more flouriſhing ſtate than it had ever been in ſince their great revolution.

Sidi Mahomet, his grandſon and ſucceſſor, had different views, and was actuated by different motives. From his inordinate avarice, he ceaſed to act towards his black troops in the generous manner which had diſtinguiſhed his predeceſſor Muley Iſhmael; and they ſoon ſhowed themſelves diſcontented with his conduct. They frequently threatened to revolt, and ſupport thoſe of his ſons who were in oppoſition, and who promiſed them the moſt liberal rewards. They offered to place his eldeſt ſon Muley Ali, who is ſince dead, on the throne; but this prince, not unmindful of the duty which he owed his father and ſovereign, declined their offer. They next applied to Muley Yazid, the late emperor, who at firſt accepted of the aſſiſtance they tendered, but in a ſhort time relinquiſhed the plan. Sidi Mahomet, diſguſted with this conduct of the negroes, determined to curb their growing power, by diſbanding a conſiderable part of theſe troops, and baniſhing them to diſtant parts of the empire. This important mode of population has therefore been of late years neglected, while no better ſyſtem has been ſubſtituted in its room; for though the late emperor indulged in cruelty much leſs frequently than his predeceſſors, yet population has, perhaps, been more completely impeded by the general poverty which he has introduced into the country by his ſevere exactions, than if he had made a liberal uſe of the ſword or of the bow-ſtring.

5 Deſpotiſm of the emperors.

A moſt flagrant ſpecies of deſpotiſm, which renders the emperors ſtill more formidable to their ſubjects, is their making themſelves their ſole heirs, and, in virtue of that, ſeizing upon all their effects, and making only ſuch proviſion for their families as they think proper; and often, on ſome frivolous pretence, leaving them deſtitute of any, according to the liking or diſlike they bear to the deceaſed; ſo that, upon the whole, they are the only makers, judges, and interpreters, and in many inſtances likewiſe the executioners, of their own laws, which have no other limits than their own arbitrary will. To preſerve, however, ſome ſhow or ſhadow of juſtice, they allow their mufti a kind of ſuperiority in ſpirituals, and a ſort of liberty to the meaneſt ſubject to ſummon them before his tribunal. But the danger which ſuch an attempt would bring upon a plaintiff, perhaps no leſs than death and deſtruction, is of itſelf ſufficient to deter any man from it; eſpecially conſidering the little probability there is that the judges of it would run the riſk of declaring themſelves againſt a monarch whoſe creatures they are, and on whom their lives and fortunes ſo abſolutely depend. The titles which the emperors of Morocco aſſume, are thoſe of *Moſt glorious, mighty, and noble emperor of Afric, king of Fez and Morocco, Taphilet, Suz, Darha, and all the Algarbe, and its territories in Afric; grand Sharif* (or, as others write it, *Xarif*, that is, "ſucceſſor, or vicegerent,") *of the great prophet Mohammed, &c.*

6 Adminiſtration of juſtice.

The judges or magiſtrates that act immediately under the emperor are either ſpiritual or temporal, or rather eccleſiaſtical and military. The mufti and the kadis are judges of all religious and civil affairs; and the baſhaws, governors, alcaides, and other military officers, of thoſe that concern the ſtate or the army: all of them the moſt obſequious creatures and ſlaves of their prince, and no leſs the rapacious tyrants of his ſubjects, and from whom neither juſtice nor favour can be obtained but by mere dint of money and extortionate bribery, from the higheſt to the loweſt. Neither can it indeed be otherwiſe in ſuch an arbitrary government, where the higheſt poſts muſt not only be bought of the prince at a moſt extravagant price, and kept only by as exorbitant a tribute, which is yearly paid to him, but where no one is ſure to continue longer than he can bribe ſome of the courtiers to inſinuate to the monarch that he pays to the utmoſt of his power, and much beyond what was expected from him. Add to this, that thoſe baſhaws, governors, &c. are obliged to keep their agents and ſpies in conſtant pay at court, to prevent their being ſupplanted by higher bidders, ſlanderers, or other underminers. In ſhort, power and weakneſs, rank and meanneſs, opulence and indigence, are here equally dependent, equally uncertain. There are inſtances of the ſultan elevating at once a common ſoldier to the rank of a baſhaw, or making him a confidential friend; the following day he would perhaps impriſon him, or reduce him again to the ſtation of a private ſoldier. It is ſurpriſing that men under theſe circumſtances ſhould be ambitious of rank, or deſirous of riches and power. Yet ſuch is the diſpoſition of theſe people, that they have an unbounded thirſt for rank and power with all their uncertainties; and what is more extraordinary, when they have obtained a high ſtation, they ſeldom fail to afford their ſovereign a plea for ill treating them, by abuſing in ſome way or other their truſt.

7 Royal revenues.

From what has been ſaid, it may be reaſonably concluded that the revenue ariſing to the emperor from the laſt mentioned ſource, that of bribery, extortion, and confiſcation, muſt be very conſiderable, though there is no poſſibility to make any other conjecture of its real amount than that it muſt be an immenſe one. Another conſiderable branch is the piratical trade, which brings the greater income into his treaſury, as he is not at any expence either for fitting of corſair veſſels out, or maintaining their men; and yet has the tenth of all the cargo and of all the captives; beſides which, he appropriates to himſelf all the reſt of them, by paying the captors 50 crowns *per* head, by which means he engroſſes all the ſlaves to his own ſervice and advantage. This article is indeed a

Morocco. very confiderable addition to his revenue, not only as he fells their ranfom at a very high rate, but likewife as he has the profit of all their labour, without allowing them any other maintenance than a little bread and oil, or any other affiftance when fick than what medicines a Spanifh convent, which he tolerates there, gives them gratis; and which, neverthelefs, is forced to pay him an annual prefent for that toleration, befides furnifhing the court with medicines, and the flaves with lodging and diet when they are not able to work. Another branch of his revenue confifts in the tenth part of all cattle, corn, fruits, honey, wax, hides, rice, and other products of the earth, which is exacted of the Arabs and Brebes, as well as of the natives; and thefe are levied, or rather farmed, by the bafhaws, governors, alcaides, &c. with all poffible feverity. The Jews and Chriftians likewife pay an income or capitation, the former of fix crowns *per* head on all males from 15 years and upwards, befides other arbitrary impofts, fines, &c. That on the Chriftians, for the liberty of trading in his dominions, rifes and falls according to their number, and the commerce they drive; but which, whatever it may bring yearly into his coffers, is yet detrimental to trade in general, feeing it difcourages great numbers from fettling there, notwithftanding the artful invitations which the emperors and their minifters make ufe of to invite them to it; for, befides thofe arbitrary exactions, there is ftill another great hardfhip attending them, viz. that they cannot leave the country without forfeiting all their debts and effects to the crown. The duties on all imports and exports is another branch of his income, the amount of which, *communibus annis*, no author has yet given us any account of; only conful Hatfield has computed the whole yearly revenue, including ordinaries and extraordinaries, to amount to 500 quintals of filver, each quintal, or 100 lb. weight, valued at fomewhat above 330 l. Sterling: fo that the whole amounts to no more, according to him, than 165,000 l.; a fmall revenue indeed for fo large an empire, if the calculation may be depended upon. But St Olan, though he does not pretend fo much as to guefs at the yearly amount of it, in general reprefents it as fo confiderable, that Muley Ifhmael was reckoned to have amaffed out of it a treafure in gold and filver of about 50 effective millions; but whether of crowns or livres he does not tell us, nor how he came by his knowledge of it; becaufe that politic prince, even by his own confeffion, not only caufed all his riches to be buried in fundry places under-ground, his gold and filver to be melted into great lumps, and laid in the fame privacy underground, but likewife all thofe whom he entrufted with the fecret to be as privately murdered.

8 Climate of Morocco.

The climate of the empire of Morocco is in general fufficiently temperate, healthy, and not fo hot as its fituation might lead us to fuppofe. The chain of mountains which form Atlas, on the eaftern fide, defends it from the eaft winds, that would fcorch up the earth were they frequent. The fummit of thefe mountains is always covered with fnow; and their abundant defcending ftreams fpread verdure through the neighbourhood, make the winter more cold, and temper the heats of fummer. The fea on the weft fide, which extends along the coaft from north to fouth, alfo refrefhes the land with regular breezes, that feldom vary according to their feafons. At a diftance from the fea, within land, the heat is fo great, that the rivulets become dry in fummer; but as in hot countries dews are plentiful, the nights are there always cool. The rains are tolerably regular in winter; and are even abundant, though the atmofphere is not loaded with clouds as in northern latitudes. Thofe rains which fall by intervals are favourable to the earth, and increafe its fecundity. In January the country is covered with verdure, and enamelled with flowers. Barley is cut in March, but the wheat harveft is in June. All fruits are early in this climate; and in forward years the vintage is over in the beginning of September. Though in general there is more uniformity and lefs variation in hot than in northern climates, the firft are neverthelefs expofed to the intemperance of weather: too heavy rains often impede the harveft; and drought has ftill greater inconveniences, for it enfures the propagation of locufts. Thefe fatal infects, which have fo often laid defolate hot countries, fometimes commit the moft dreadful ravages in the empire of Morocco. They come from the fouth, fpread themfelves over the lands, and increafe to infinity when the rains of fpring are not fufficiently heavy to deftroy the eggs they depofit on the earth. The large locufts, which are near three inches long, are not the moft deftructive: as they fly, they yield to the current of wind, which hurries them into the fea, or into fandy deferts, where they perifh with hunger or fatigue. The young locufts, that cannot fly, are the moft ruinous; they creep over the country in fuch multitudes, that they leave not a blade of grafs behind; and the noife of their feeding announces their approach at fome diftance. The devaftations of locufts increafe the price of provifions, and often occafion famines: but the Moors find a kind of compenfation in making food of thefe infects; prodigious quantities of which are brought to market falted and dried like red herrings. They have an oily and rancid tafte, which habit only can render agreeable: they are eat here, however, with pleafure. The winters in Morocco are not fevere, nor is there an abfolute need of fire. In the coldeft weather the thermometer feldom finks to more than five degrees above the freezing point. The longeft days in Morocco are not more than 14 hours, and the fhorteft confequently not lefs than ten.

The foil of Morocco is exceedingly fertile. It is moft fo in the inland provinces. On the weftern coaft it is in general light and ftony, and is better adapted to the vine and olive than the culture of wheat. They annually burn, before the September rains, the ftubble, which is left rather long; and this and the dung of cattle, every day turned to pafture, form the fole manure the land receives. The foil requires but little labour, and the ploughing is fo light that the furrows are fcarcely fix inches deep; for which reafon, in fome provinces, wooden ploughfhares are ufed for cheapnefs. 9 Soil, and

The empire of Morocco might fupply itfelf with all neceffaries, as well from the abundance and nature of its products, as from the few natural or artificial wants of the Moors occafioned by climate or education. Its wealth confifts in the fruitfulnefs of its foil: its corn, fruits, flocks, flax, falt, gums, and wax, would not only fupply its neceffities, but yield a fuperflux, which might become

Morocco.

10 Productions.

become an object of immense trade and barter with other nations. Such numerous exports might return an inexhaustible treasure, were its government fixed and secure, and did subjects enjoy the fruits of their labour and their property in safety. The increase of corn in Morocco is often as sixty to one, and thirty is held to be but an indifferent harvest. The exportation of this corn is burdened by the laws, and by the prejudices of an intolerant religion, which permits them not to sell their superabundance to infidels. The property of land is besides entirely precarious; so that each individual grows little more than sufficient for his own wants. Hence it happens, when the harvest fails from the ravages of locusts or the intemperance of seasons, these people are exposed to misery, such as Europeans have no conception of, who enjoy a stable administration, which obviates and provides for all their wants.

The Moors, naturally indolent, take little care of the culture of their fruits. Oranges, lemons, and thick-skinned fruits, the trees of which require little nurture, grow in the open fields; and there are very large plantations of them found, which they take the trouble to water in order to increase their product. Their vines, which yield excellent grapes, are planted as far as the 33d degree, as in the southern provinces of France, and are equally vigorous. But at Morocco, where they yield a large and delicious grape, they are supported by vine-poles five and six feet above ground; and as they are obliged to be watered, the little wine made there is seldom preserved. Figs are very good in some parts of the empire, but toward the south they are scarcely ripe before they are full of worms; the heats and night dews may, perhaps, contribute to this speedy decay. Melons, for the same reason, are rarely eatable; they have but a moment of maturity; which passes so rapidly that it is with difficulty seized. Water-melons are every where reared, and in some provinces are excellent. Apricots, apples, and pears, are in tolerable plenty in the neighbourhood of Fez and Mequinez, where water is less scarce and the climate more temperate. But in the plain, which extends along the western coast, these delicate fruits are very indifferent, have less juice or taste, and the peaches there do not ripen. The tree called the prickly pear, or the Barbary fig, is plentifully found in the empire of Morocco; and is planted round vineyards and gardens, because its thick and thorny leaves, which are wonderfully prolific, form impenetrable hedges. From these leaves a fruit is produced, covered with a thorny skin, that must be taken off with care. This fruit is mild, and full of very hard, small, kernels. The olive is every where found along the coast, but particularly to the south. The trees are planted in rows, which form alleys the more agreeable because the trees are large, round, and high in proportion. They take care to water them, the better to preserve the fruit. Oil of olives might here be plentifully extracted, were taxation fixed and moderate; but such has been the variation it has undergone, that the culture of olives is so neglected as scarcely to produce oil sufficient for internal consumption. In 1768 and 1769 there were near 40,000 quintals of oil exported from Mogodore and Santa-Cruz to Marseilles, and ten years after it cost 15 d. per pound. Thus do the vices of government expose nations to dearth and famine who live in the very bosom of abundance.

Morocco.

From the province of Duquella to the south of the empire, there are forests of the arga tree, which is thorny, irregular in its form, and produces a species of almond exceedingly hard, with a skin as corrosive as that of walnuts. Its fruit consists of two almonds, rough and bitter, from which an oil is produced very excellent for frying. In order to use this oil, it must be purified by fire, and set in a flame, which must be suffered to die away of itself; the most greasy and corrosive particles are consumed, and its acrid qualities are thus wholly destroyed. When the Moors gather these fruits, they bring their goats under the trees; and as the fruit falls, the animals carefully nibble off the skins. In the same province also is found the tree which produces gum sandarac; also that which yields the transparent gum; but the latter is most productive, and affords the best gum the farther we proceed southward, where the heat and night-dews may perhaps render the vegetable secretion more pure and copious.

In the province of Suz, between the 25th and 30th degrees, the inhabitants have an almond harvest, which varies little because of the mildness of the climate; but the fruit is small, for which reason they take little care of the trees, and they degenerate with time. The palm tree is common in the southern provinces of Morocco; but dates ripen there with difficulty, and few are good except in the province of Suz and toward Tafilet. On the coast of Sallee and Mamora there are forests of oak, which produce acorns near two inches long. They taste like chesnuts, and are eat raw and roasted. This fruit is called *Bellote*, and is sent to Cadiz. where the Spanish ladies hold it in great estimation. The empire of Morocco also produces much wax: but since it has been subjected by the emperor to the payment of additional duties, the country people have very much neglected the care of their hives. Salt abounds in the empire, and in some places on the coast requires only the trouble of gathering. Independent of the salt-pits formed by the evaporation of the soft water, there are pits and lakes in the country whence great quantities are obtained. It is carried even as far as Tombut, whence it passes to the interior parts of Africa.

The Moors cultivate their lands only in proportion to their wants; hence two-thirds of the empire at least lie waste. Here the *doum*, that is, the fan or wild palm tree, grows in abundance; and from which those people, when necessity renders them industrious, find great advantage. The shepherds, mule-drivers, camel-drivers, and travellers, gather the leaves, of which they make mats, fringes, baskets, hats, *shoaris* or large wallets to carry corn, twine, ropes, girths, and covers for their pack-saddles. This plant, with which also they heat their ovens, produces a mild and resinous fruit that ripens in September and October. It is in form like the raisin, contains a kernel, and is astringent and very proper to temper and counteract the effects of the watery and laxative fruits, of which these people in summer make an immoderate use.

Unacquainted with the sources of wealth of which their ancestors were possessed, the Moors pretend there are gold and silver mines in the empire, which the emperors 11 Mines.

perors will not permit to be worked, leſt their ſubjects ſhould thus find means to ſhake off their yoke. It is not improbable but that the mountains of Atlas may contain unexplored riches; but there is no good proof that they have ever yielded gold and ſilver. There are known iron mines in the ſouth; but the working of them has been found ſo expenſive, that the natives would rather uſe imported iron, notwithſtanding the heavy duty it pays, by which its price is doubled. There are copper mines in the neighbourhood of Santa Cruz, which are not only ſufficient for the ſmall conſumption of the empire, where copper is little uſed, but are alſo an object of exportation, and would become much more ſo were the duties leſs immoderate.

12 Animals. Neither the elephant nor the rhinoceros is to be found either in this or the other ſtates of Barbary; but their deſerts abound with lions, tigers, leopards, hyænas, and monſtrous ſerpents. The Barbary horſes were formerly very valuable, and thought equal to the Arabian. Though their breed is now ſaid to be decayed, yet ſome very fine ones are occaſionally imported into England. Camels and dromedaries, aſſes, mules, and kumrahs (a moſt ſerviceable creature, begot by an aſs upon a cow), are their beaſts of burden. Their cows are but ſmall, and barren of milk. Their ſheep yield but indifferent fleeces, but are very large, as are their goats. Bears, porcupines, foxes, apes, hares, rabbits, ferrets, weaſels, moles, cameleons, and all kinds of reptiles, are found here. Partridges and quails, eagles, hawks, and all kinds of wild-fowl, are frequent on the coaſt.

13 Mountains, &c. As to mountains, the chief are that chain which goes under the name of *Mount Atlas*, and runs the whole length of Barbary from eaſt to weſt, paſſing through Morocco, and abutting upon that ocean which ſeparates the eaſtern from the weſtern continent, and is from this mountain called the *Atlantic Ocean*. See Atlas. The principal rivers, beſides the Malva or Mulvia above-mentioned, which riſes in the deſarts, and running from ſouth to north divides Morocco from the kingdom of Algiers, are the Suz, Ommirabih, Rabbata, Larache, Darodt, Sebon, Gueron, and Tenſift, which riſe in Mount Atlas, and fall into the Atlantic Ocean. The chief capes are Cape Threeforks on the Mediterranean, Cape Spartel at the entrance of the ſtraits, Cape Cantin, Cape None, and Cape Rajador, on the Atlantic Ocean. Of the bays the moſt conſiderable are, the bay of Tetuan in the Mediterranean, and the bay of Tangier in the ſtraits of Gibraltar.

14 Inland traffic. The traffic of the empire by land is either with Arabia or Negroland: to Mecca they ſend caravans, conſiſting of ſeveral thouſand camels, horſes, and mules, twice every year, partly for traffic, and partly on a religious account; for numbers of pilgrims take that opportunity of paying their devotions to their great prophet. The goods they carry to the eaſt are woollen manufactures, leather, indigo, cochineal, and oſtrich feathers; and they bring back from thence, ſilk, muſlins, and drugs. By their caravans to Negroland, they ſend ſalt, ſilk, and woollen manufactures, and bring back gold and ivory in return, but chiefly negroes.

15 Traffic. The caravans always go ſtrong enough to defend themſelves againſt the wild Arabs in the deſarts of Africa and Aſia; though, notwithſtanding all their vigilance, ſome of the ſtragglers and baggage often fall into their hands: they are alſo forced to load one half of their camels with water, to prevent their periſhing with drought and thirſt in thoſe inhoſpitable deſarts. And there is ſtill a more dangerous enemy, and that is the ſand itſelf: when the winds riſe, the caravan is perfectly blinded with duſt; and there have been inſtances both in Africa and Aſia, where whole caravans, and even armies, have been buried alive in the ſands. There is no doubt alſo, but both men and cattle are ſometimes ſurpriſed by wild beaſts, as well as robbers, in thoſe vaſt deſarts; the hot winds alſo, blowing over a long tract of burning ſand, are equal almoſt to the heat of an oven, and deſtroy abundance of merchants and pilgrims. If it was not for devotion, and in expectation of very great gains, no man would undertake a journey in theſe deſarts; great are the hazards and fatigues they muſt of neceſſity undergo; but thoſe that go to Mecca aſſure themſelves of paradiſe if they die, and have uncommon honours paid them at home if they ſurvive. People crowd to be taken into the eaſtern caravans; and the gold that is found in the ſouth make them no leſs eager to undertake that journey.

The natives have hardly any trading veſſels, but are ſeldom without ſome corſairs. Theſe, and European merchant-ſhips, bring them whatever they want from abroad; as linen and woollen cloth, ſtuffs, iron wrought and unwrought, arms, gunpowder, lead, and the like: for which they take in return, copper, wax, hides, Morocco leather, wool (which is very fine), gums, ſoap, dates, almonds, and other fruits. The duties paid by the Engliſh in the ports of Morocco are but half thoſe paid by other Europeans. It is a general obſervation, that no nation is fond of trading with theſe ſtates, not only on account of their capricious deſpotiſm, but the villany of their individuals, both natives and Jews, many of whom take all opportunities of cheating, and when detected are ſeldom puniſhed. 16 Foreign commerce.

The land-forces of the emperor of Morocco conſiſt principally of the black troops already mentioned, and ſome few white; amounting altogether to an army of about 36,000 men upon the eſtabliſhment, two thirds of which are cavalry. This eſtabliſhment, however, upon occaſion admits of a conſiderable increaſe, as every man is ſuppoſed to be a ſoldier, and when called upon is obliged to act in that capacity. About 6000 of the ſtanding forces form the emperor's body guard, and are always kept near his perſon; the remainder are quartered in the different towns of the empire, and are under the charge of the baſhaws of the provinces. They are all clothed by the emperor, and receive a trifling pay; but their chief dependence is on plunder, which they have frequent opportunities of acquiring. The ſoldiers have no diſtinction in dreſs from the other Moors; and are only marked by their accoutrements, which conſiſt of a ſabre, a very long muſket, a ſmall red leathern box to hold their balls, which is fixed in front by means of a belt, and a powder-horn flung over their ſhoulders. The army is under the direction of a commander in chief, four principal baſhaws, and alcaides who command diſtinct diviſions. 17 Land-forces.

The black troops are naturally of a very fiery diſ-

poſition, capable of enduring great fatigue, hunger, thirſt, and every difficulty to which a military life is expoſed. They appear well calculated for ſkirmiſhing parties, or for the purpoſe of haraſſing an enemy; but were they obliged to undergo a regular attack, from their total want of diſcipline they would ſoon be routed. In all their manœuvres they have no notion whatever of order and regularity, but have altogether more the appearance of a rabble than of an army. Though theſe troops are ſuppoſed to be the ſtrongeſt ſupport of deſpotiſm, yet from their avarice and love of variety they frequently prove the moſt dangerous enemies to their monarchs; they are often known to excite ſedition and rebellion, and their inſolence has ſometimes proceeded to ſuch exceſſes as nearly to overturn the government. Their conduct is governed only by the paſſions. Thoſe who pay them beſt, and treat them with the greateſt attention, they will always be moſt ready to ſupport. This circumſtance, independent of every other, makes it the intereſt of the monarch to keep his ſubjects in as complete a ſtate of poverty as poſſible. The Moors are indeed remarkable for inſincerity in their attachments, and for their love of variety; a military force, in this kingdom eſpecially, is therefore the only means which a deſpotic monarch can employ for ſecuring himſelf in the poſſeſſion of the throne. Ignorant of every principle of rational liberty, whatever conteſts this devoted people may engage in with their tyrants, are merely conteſts for the ſucceſſion; and the ſole object for which they ſpend their lives and their property, is to exchange one merciless deſpot for another.

18 Navy. The emperor's navy conſiſts of about 15 ſmall frigates, a few zebecks, and between 20 and 30 row-galleys. The whole is commanded by one admiral; but as theſe veſſels are principally uſed for the purpoſes of piracy, they ſeldom unite in a fleet. The number of the ſeamen in ſervice are computed at 6000.

19 Coins. The coins of this empire are a fluce, a blanquil, and ducat. The fluce is a ſmall copper coin, twenty whereof make a blanquil, of the value of two-pence Sterling. The blanquil is of ſilver, and the ducat of gold, not unlike that of Hungary, and work about nine ſhillings. Both theſe pieces are ſo liable to be clipped and filed by the Jews, that the Moors always carry ſcales in their pockets to weigh them; and when they are found to be much diminiſhed in their weight, they are recoined by the Jews, who are maſters of the mint, by which they gain a conſiderable profit; as they do alſo by exchanging the light pieces for thoſe that are full weight. Merchants accounts are kept in ounces, ten of which make a ducat; but in payments to the government, it is ſaid they will recken ſeventeen one-half for a ducat.

20 Religion and With reſpect to religion, the inhabitants of Morocco are Mohammedans, of the ſect of Ali; and have a mufti or high-prieſt, who is alſo the ſupreme civil magiſtrate, and the laſt reſort in all cauſes eccleſiaſtical and civil. They have a great veneration for their hermits, and for idiots and madmen; as well as for thoſe who by their tricks have got the reputation of wizzards: all whom they look upon as inſpired perſons, and not only honour as ſaints while they live, but build tombs and chapels over them when dead; which places are not only religiouſly viſited by their devotees far and near, but are eſteemed inviolable ſanctuaries for all ſorts of criminals except in caſes of treaſon.

Notwithſtanding the natives are zealous Mohammedans, they allow foreigners the free and open profeſſion of their religon, and their very ſlaves have their prieſts and chapels in the capital city; though it muſt be owned that the Chriſtian ſlaves are here treated with the utmoſt cruelty. Here, as in all other Mo- 21 Laws.
hammedan countries, the alcoran and their comments upon it are their only written laws; and though in ſome inſtances their cadis and other civil magiſtrates are controlled by the arbitrary determinations of their princes, baſhaws, generals, and military officers, yet the latter have generally a very great deference and regard for their laws. Murder, theft, and adultery, are commonly puniſhed with death: and their puniſhments for other crimes, particularly thoſe againſt the ſtate, are very cruel; as impaling, dragging the priſoner through the ſtreets at a mule's heels till all his fleſh is torn off; throwing him from a high tower upon iron hooks; hanging him upon hooks till he die; crucifying him againſt a wall; and, indeed, the puniſhment and condemnation of criminals is in a manner arbitrary. The emperor, or his baſhaws, frequently turn executioners; ſhoot the offender, or cut him to pieces with their own hands, or command others to do it in their preſence.

22 Inhabitants of the empire of Morocco. The inhabitants of the empire of Morocco, known by the name of *Moors*, are a mixture of Arabian and African nations formed into tribes; with the origin of whom we are but imperfectly acquainted. Theſe tribes, each ſtrangers to the other, and ever divided by traditional hatred or prejudice, ſeldom mingle. It ſeems probable that moſt of the caſts who occupy the provinces of Morocco have been repulſed from the eaſtern to the weſtern Africa, during thoſe different revolutions by which this part of the world has been agitated; that they have followed the ſtandard of their chiefs, whoſe names they have preſerved; and that by theſe they, as well as the countries they inhabit, are diſtinguiſhed. At preſent theſe tribes are called *cafiles* or *cabiles*, from the Arabic word *kobeila*; and they are ſo numerous, that it is impoſſible to have a knowledge of them all. In the northern provinces are enumerated Beni-Garir, Beni-Guernid, Beni-Manſor, Beni-Oriegan, Beni-Chelid, Beni-Juſeph, Beni-Zaruol, Beni-Razin, Beni-Gebara, Beni-Buſeibet, Beni-Gualid, Beni-Yeder, Beni-Gueiaghel, Beni-Guatev al, Beni-Guamud, &c. Toward the eaſt are, Beni-Sayd, Beni-Teuſin, Beni-Ieſſetin, Beni-Buhalel, Beni-Telid, Beni-Soffian, Beni-Becil, Beni-Zequer, &c.—and to the ſouth, thoſe of Beni-Fonſecara, Beni-Aros, Beni-Haſſen, Beni-Mager, Beni-Baſil, Beni-Seba, with an infinite number of others (A). The people

(A) The word *Ben*, that is to ſay "Son," is uſually employed to ſignify "family deſcendants;" thus, *Beni-Haſſen*, and *Beni-Juſeph*, ſignify, "the children or deſcendants of Haſſen and of Joſeph." The Moors, as a more extenſive generic term, call men *Ben-Adam*; that is, "the deſcendants or ſons of Adam."

Morocco. people who depend on Algiers, Tunis, and Tripoli, are in like manner divided into an infinite number of these tribes, who are all so ancient that they themselves have not the least idea of their origin.

The native subjects of the empire of Morocco may be divided into two principal classes; the *Brebes* and the *Moors*.

23 The Brebes, or Mountaineers. The etymology of the name, and the origin of the people, of the first class, are equally unknown. Like the Moors, at the time of the invasion by th. Arabs, they may have adopted the Mahometan religion, which is consonant to their manners and principal usages; but they are an ignorant people, and observe none of the precepts of that religion, but the aversion it enjoins against other modes of worship.—Mahometanism has not obliterated the customs and ancient prejudices of these people, for they eat the wild boar; and in places where there are vineyards, they drink wine, *provided* (say they) *that it is of our own making*. In order to preserve it in the southern parts of Mount Atlas, they put it in earthen vessels, and in barrels made of the hollowed trunk of a tree, the upper end of which is done over with pitch; and these are deposited in cellars, or even in water. In the northern province of Rif they boil it a little, which renders it less apt to inebriate, and perhaps they think that in this state they may reconcile the use of it with the spirit of their law.

Confined to the mountains, the Brebes preserve great animosity against the Moors, whom they confound with the Arabs, and consider as usurpers.—They thus contract in their retreats a ferocity of mind, and a strength of body, which makes them more fit for war and every kind of labour than the Moors of the plain in general are. The independence they boast of gives even a greater degree of expression to their countenance. The prejudices of their religion make them submit to the authority of the emperors of Morocco; but they throw off the yoke at their pleasure, and retire into the mountains, where it is difficult to attack or overcome them. The Brebes have a language of their own, and never marry but among each other. They have tribes or cafiles among them who are exceedingly powerful both by their number and courage. Such are those of Gomera on the borders of Rif, of Gayroan toward Fez, of Timoor extending along mount Atlas from Mequinez to Tedla, of Shavoya from Tedla to Duquella, and of Mishboya, from Morocco to the south. The emperor of Morocco keeps the children of the chiefs of these tribes at court as hostages for their fidelity. The Brebes have no distinction of dress; they are always clothed in woollen like the Moors; and, though they inhabit the mountains, they rarely wear any thing on their heads. These mountaineers, as well as their wives, have exceedingly fine teeth; and possess a degree of vigour and intrepidity which distinguishes them from the inhabitants of the plains. It is common for them to hunt lions and tigers; and the mothers have a custom of decorating their children with a tiger's claw or the remnant of a lion's hide on the head, thinking that by this means they will acquire strength and courage; and from a similar superstition, young wives are in use to give their husbands the same as a sort of amulets.

The Brebes and the Shellu having a language common to themselves, and unknown to the Moors, both must have had the same origin, notwithstanding the difference there is in their mode of life. The *Shellu* live on the frontiers of the empire toward the south; their population is by no means so great as that of the Brebes, nor are they so ferocious: they do not marry with other tribes; and though they practise many superstitious rites, they are faithful observers of their religion.

The *Moors* of the plains may be distinguished into those who lead a pastoral life, and those who inhabit the cities.

The former live in tents; and that they may allow their ground a year's rest, they annually change the place of their encampments, and go in search of fresh pasturage; but they cannot take this step without acquainting their governor. Like the ancient Arabs, they are entirely devoted to a pastoral life: their encampments, which they call *douhars*, are composed of several tents, and form a crescent; or they are ranged in two parallel lines, and their flocks, when they return from pasture, occupy the centre. The entrance of the douhar is sometimes shut with faggots of thorns; and the only guard is a number of dogs, that bark incessantly at the approach of a stranger. Each douhar has a chief, subordinate to an officer of the highest rank, who has under his administration a number of camps; and several of these subordinate divisions are united under the government of a bacha, who has often 1000 douhars in his department. 24 The Moors of the country.

The tents of the Moors, viewed in front, are of a conical figure; they are from 8 to 10 feet high, and from 20 to 25 feet long; like those of high antiquity, they resemble a boat reversed. They are made of cloth composed of goats and camels hair, and the leaves of the wild palm, by which they are rendered impervious to water; but at a distance their black colour gives them a very disagreeable look.

25 Their simple way of life. The Moors, when encamped, live in the greatest simplicity, and exhibit a faithful picture of the inhabitants of the earth in the first ages of the world. The nature of their education, the temperature of the climate, and the rigour of the government, diminish the wants of the people, who find in their plains, in the milk and wool of their flocks, every thing necessary for food and cloathing. Polygamy is allowed among them; a luxury so far from being injurious to a people who have few wants, that it is a great convenience in the economy of those societies, because the women are intrusted with the whole care of the domestic management. In their half-closed tents, they are employed in milking the cows for daily use; and when the milk abounds, in making butter, in picking their corn, their barley, and pulse, and grinding their meal, which they do daily in a mill composed of two stones about 18 inches in diameter, the uppermost having a handle, and turning on an axis fixed in the under one: they make bread likewise every day, which they bake between two earthen plates, and often upon the ground after it has been heated by fire. Their ordinary food is the coofcoofoo; which is a paste made with their meal in the form of small grains like Italian paste. This coofcoofoo is drest in the vapour of boiling soup, in a hollow dish perforated with many small holes in the bottom, 26 Occupations of the women, &c.

Morocco. tom, and the dish is inclosed in a kettle where meat is boiled; the coofcoofoo, which is in the hollow dish, grows gradually soft by the vapour of the broth, with which it is from time to time moistened. This simple food is very nourishing, and even agreeable when one has got the better of the prejudices which every nation entertains for its own customs. The common people eat it with milk or butter indifferently; but those of higher rank, such as the governors of provinces and lieutenants, who live in the centre of the encampments, add to it some succulent broth, made with a mixture of mutton, poultry, pigeons, or hedgehogs, and then pour on it a sufficient quantity of fresh butter. These officers receive strangers in their tents with the same cordiality that Jacob and Laban showed to their guests. Upon their arrival a sheep is killed and immediately dressed; if they are not provided with a spit, they instantly make one of wood; and this mutton roasted at a brisk fire, and served up in a wooden dish, has a very delicate colour and taste.

The women in their tents likewise prepare the wool, spin it, and weave it into cloth on looms suspended the whole length of the tent. Each piece is about five ells long and one and an half broad; it is neither dressed nor dyed, and it has no seam; they wash it when it is dirty; and as it is the only habit of the Moors, they wear it night and day. It is called *Haique*, and is the true model of the ancient draperies.

27 Dress, &c. The Moors of the plain wear nothing but their woollen stuff; they have neither shirts nor drawers. Linen among these people is a luxury known only to those of the court or the city. The whole wardrobe of a country Moor in easy circumstances consists in a haique for winter, another for summer, a red cape, a hood, and a pair of slippers. The common people both in the country and in towns wear a kind of tunick of woollen cloth, white, grey, or striped, which reaches to the middle of the leg, with great sleeves and a hood; it resembles the habit of the Carthusians.

The womens dress in the country is likewise confined to a haique, which covers the neck and the shoulders, and is fastened with a silver clasp. The ornaments they are fondest of are ear-rings, which are either in the form of rings or crescents, made of silver, bracelets, and rings for the small of the leg; they wear these trinkets at their most ordinary occupations; less out of vanity than because they are unacquainted with the use of caskets or cabinets for keeping them. They also wear necklaces made of coloured glass-beads or cloves strung on a cord of silk.

Besides these ornaments, the women, to add to their beauty, imprint on their face, their neck, their breast, and on almost every part of their body, representations of flowers and other figures. The impressions are made with a piece of wood stuck full of needles; with the points of which they gently puncture the skin, and then lay it over with a blue-coloured substance or gunpowder pulverised, and the marks never wear out. This custom, which is very ancient, and which has been practised by a variety of nations, in Turkey, over all Asia, in the southern parts of Europe, and perhaps over the whole globe, is, however, not general among the Moorish tribes.

The Moors consider their wives less in the light of companions than in that of slaves destined to labour. Except in the business of tillage, they are employed in every servile operation; nay, to the shame of humanity, it must be owned, that in some of the poorer quarters a woman is often seen yoked in a plough along with a mule, an ass, or some other animal. When the Moors remove their douhars, all the men seat themselves in a circle on the ground; and with their elbows resting on their knees, pass the time in conversation, while the women strike the tents, fold them up into bundles, and place them on the backs of their camels or oxen. The old women are then each loaded with a parcel, and the young carry the children on their shoulders suspended in a cloth girt round their bodies. In the more southern parts, the women are likewise employed in the care of the horses, in saddling and bridling them; the husband, who in these climates is always a despot, issues his orders, and seems only made to be obeyed.

The women travel without being veiled; they are accordingly sun-burnt, and have no pretensions to beauty. There are, however, some quarters where they put on a little rouge: they every where stain their hair, their feet, and the ends of their fingers, with an herb called *henna*, which gives them a deep saffron colour; a custom that must be very ancient among the people of Asia. Abu Becre dyed his eye-brows and beard with the same colour, and many of his successors imitated him. The custom may have originally been a religious ceremony, which the women have turned into an ornament; but it is more probable that the custom of painting the beard and hair, and that of shaving the head and using depilatories in other parts of the body, has been at first employed from motives of cleanliness in warm countries.

The marriage ceremonies of the Moors that live in tents pretty much resemble those of the same people that live in the cities. In the douhars they are generally most brilliant and gay; the strangers that pass along are invited, and made to contribute to the feast; but this is done more from politeness than from any mercenary motive. 28 Marriages, &c.

The tribes of the plain generally avoid mixing by marriage with one another: the prejudices that divide these people are commonly perpetuated; or, if they are partially healed, they never fail to revive upon trifling occasions, such as a strayed camel, or the preference of a pasture or a well. Marriages have sometimes taken place among them, that, so far from cementing their differences, have occasioned the most tragical scenes. Husbands have been known to murder their wives, and women their husbands, to revenge national quarrels.

Parents are not encumbered with their children, however numerous they may be, for they are very early employed in domestic affairs; they tend the flocks, they gather wood, and they assist in ploughing and reaping. In the evening, when they return from the field, all the children of the douhar assemble in a common tent, where the Iman, who himself can hardly spell, makes them read a few sentences from the Koran written on boards, and instructs them in their religion by the light of a fire made of straw, of bushes, and cow-dung dried in the sun. As the heat is very great

Morocco. great in the inland parts of the country, children of both fexes go quite naked till the age of nine or ten.

29 Entertainment of travellers. The douhars difperfed over the plains are always in the neighbourhood of fome rivulet or fpring, and they are a kind of inns for the reception of travellers. There is generally a tent erected for their ufe, if they have not brought one along with them. They are accommodated with poultry, milk, and eggs, and with whatever is neceffary for their horfes. Inftead of wood for fuel, they have the cow-dung, which, when mixed with charcoal, makes a very brifk fire. The falts that abound in the vegetables of warm countries give this dung a confiftence which it has not perhaps in northern regions. A guard is always fet on the tents of travellers, efpecially if they are Europeans, becaufe the opinion of their wealth might tempt the avidity of the Moors, who are naturally inclined to thieving.

With refpect to the roads, a very judicious policy is eftablifhed, which is adapted to the character of the Moors, and to their manner of life. The douhars are refponfible for robberies committed in their neighbourhood and in fight of their tents: they are not only obliged to make reftitution, but it gives the fovereign a pretence for exacting a contribution proportioned to the abilities of the douhar. In order to temper the rigour of this law, they are made refponfible only for fuch robberies as are committed during the day; thofe that happen after fun-fet are not imputed to them, as they could neither fee nor prevent them: on this account, people here travel only from fun-rifing to funfetting.

30 Markets. To facilitate the exchange of neceffaries, there is in the fields every day except Friday, which is a day of prayer, a public market in the different quarters of each province. The Moors of the neighbourhood affemble to fell and buy cattle, corn, pulfe, dried fruits, carpets, haiques, and in fhort all the productions of the country. This market, which is called *Soc*, refembles our fairs. The buftle of the people who go and come, gives a better idea of the manner of life of the Moors than can be had in the cities. The Alcaides, who command in the neighbourhood, always attend thefe markets with foldiers to keep the peace; as it frequently happens that the grudges which thefe tribes harbour againft one another break out upon fuch occafions into open violence. The diffolution of the foc is always the prefage of fome feditious fquabble. The fkirts of thefe markets are commonly occupied by merry Andrews, fingers, dancers, and other buffoons, who make apes dance to amufe the idle. On one fide are barbers and furgeons, to whom the fick are brought to be cured.

31 Of the Moors who dwell in cities. The Moors who inhabit the cities differ from the others only in having a little more urbanity and a more eafy deportment. Though they have the fame origin with thofe of the plains, they affect to decline all intercourfe with them. Some writers, without any foundation, have given the name of *Arabs* to the inhabitants of the towns, and that of *Moors* to thofe of the plains. But the greater part of the cities of this empire are more ancient than the invafion of the Arabs, who themfelves lived in tents.

32 Their houfes and furniture. The houfes in moft of the towns in this empire appear at a little diftance like vaulted tombs in a churchyard; and the entrance into the beft of them has but a mean appearance. The rooms are generally on the ground-floor, and whitened on the outfide. As the roofs are quite flat, they ferve as *verandos*, where the Moorifh women commonly fit for the benefit of the air; and in fome places it is poffible to pafs nearly over the whole town without having occafion to defcend into the ftreet.

As the beft apartments are all backwards, a ftable, or perhaps fomething worfe, is the place to which vifitors are firft introduced. Upon entering the houfe, the ftranger is either detained in this place or in the ftreet till all the women are difpatched out of the way; he is then allowed to enter a fquare court, into which four narrow and long rooms open by means of large folding doors, which, as they have no windows, ferve likewife to introduce light into the apartments. The court has generally in its centre a fountain; and if it is the houfe of a Moor of property, it is floored with blue and white chequered tiling. The doors are ufually painted of various colours in a chequered form, and the upper parts of them are frequently ornamented with very curious carved work. None of the chambers have fire-places; and their victuals are always dreffed in the court-yard in an earthen ftove heated with charcoal. When the vifitor enters the room where he is received by the mafter of the houfe, he finds him fitting crofs-legged and barefooted on a mattrefs, covered with fine white linen, and placed on the floor or elfe on a common mat. This, with a narrow piece of carpeting, is in general the only furniture he will meet with in Moorifh houfes, though they are not deftitute of other ornaments. In fome, for inftance, he will find the walls decorated with looking-glaffes of different fizes; in others, watches and clocks in glafs-cafes; and in fome the apartments are hung with the fkins of lions or tigers, or adorned with a difplay of mufkets and fabres. In the houfes of thofe who live in the very firft ftyle, an European mahogany bedftead, with one or two mattreffes, covered with fine white linen, is fometimes placed at each end of the room. Thefe, however, are only confidered as ornaments, as the Moors always fleep on a mattrefs or a mat placed upon the floor, and covered only with their *haick* or perhaps a quilt.

As the law of Mahomet ftrictly profcribes the ufe of pictures of every defcription, this delightful fpecies of ornament finds no place in the houfes of the Moors.

The wardrobe of the inhabitants of cities is but little different from that of thofe who live in tents.— Like the latter, they have a haick, and a hood more or lefs fine, and have alfo a hood of coarfe European cloth of dark blue for the winter. What farther diftinguifhes them from the country Moors is, that they wear a fhirt and linen drawers, and an upper garment of cotton in fummer, and of cloth in winter, which they call a *caftan*. The white or blue hood, the purpofe of which feems to be to guard againft bad weather, and which is called *bernus*, is likewife a ceremonial part of drefs; without which, together with fabre and canjer (or dagger) worn in a bandelier, perfons of condition never appear before the emperor.— Obliged as they are to conceal their riches, the Moors wear no jewels; very few have fo much as a ring, a watch, or a filver fnuff-box. They frequently carry a rofary 33 Drefs of the men.

Morocco. rofary in their hand, but without annexing any ideas of devotion to the practice, although they ufe it to recite the name of God a certain number of times in the day. After thefe momentary prayers they play with their rofary much the fame as the European ladies do with their fans. The Moorifh women feldom leave the houfe, and when they do are always veiled. The old very carefully hide their faces, but the young and handfome are fomewhat more indulgent, that is to fay toward foreigners, for they are exceedingly cautious with the Moors. Being veiled, their hufbands do not know them in the ftreet, and it is even impolite to endeavour to fee the faces of the women who pafs; fo different are the manners and cuftoms of nations. There are very fine women found among the Moors, efpecially up the country; thofe of the northern parts by no means poffefs the fame degree of grace and beauty. As females in warm countries fooner arrive at puberty, they are alfo fooner old; and this perhaps may be the reafon why polygamy has been generally adopted in fuch climates. Women there fooner lofe the charms of youth, while men ftill preferve their paffions and the powers of nature. The Moorifh women are not in general very referved. Climate has a vaft influence on the temperament of the body; and licentioufnefs is there more general and lefs reftrained, tho' as in other places its diforderly pleafures incur its attendant pains; not but that the difeafe attending illicit amours is lefs poifonous, and flower in its operations, among the Moors than in Europe, becaufe of the heat of the climate, and the great temperance of their mode of living. The women of the fouth are in general the handfomeft, and are faid to be fo referved, or fo guarded, that their very relations do not enter their houfes nor their tents. Yet fuch is the contradictory cuftom of nations, that there are tribes in thefe fame provinces among whom it is held to be an act of hofpitality to prefent a woman to a traveller. It may be there are women who dedicate themfelves to this fpecies of devotion as to an act of benevolence; for it is impoffible to defcribe all the varieties of opinion among men, or the whims to which the human fancy is fubject.

34 Drefs of the Ladies. The Moorifh women who live in cities are, as in other nations, more addicted to fhew and finery in drefs than thofe of the country; but as they generally leave the houfe only one day in the week, they feldom drefs themfelves. Not allowed to receive male vifitors, they remain in their houfes employed in their families, and fo totally in defhabille that they often wear only a fhift, and another coarfer fhift over the firft, tied round their waift, with their hair plaited and fometimes with, though often without, a cap. When dreffed, they wear an ample and fine linen fhift, the bofom embroidered in gold; a rich caftan of cloth, ftuff, or velvet, worked in gold; and one or two folds of gauze, ftreaked with gold and filk, round the head, and tied behind fo as that the fringes, intermingled with their treffes, defcend as low as the waift; to which fome add a ribband of about two inches broad, worked in gold or pearls, that encircles the forehead in form of a diadem. Their caftan is bound round their waift by a crimfon velvet girdle, embroidered in gold with a buckle of gold or filver, or elfe a girdle of tamboured ftuff, manufactured at Fez.

The women have yellow flippers, and a cuftom of wearing a kind of ftocking of fine cloth fomewhat large, which is tied below the knee and at the ankle, over which it falls in folds. This ftocking is lefs calculated to fhow what we call a handfome leg, than to make it appear thick; for to be fat is one of the rules of beauty among the Moorifh women. To obtain this quality, they take infinite pains, feed when they become thin on a diet fomewhat like forced-meat balls, a certain quantity of which is given them daily; and, in fine, the fame care is taken among the Moors to fatten young women as is in Europe to fatten fowls. The reafon of a cuftom like this may be found in the nature of the climate and the quality of the aliments, which make the people naturally meagre. Our flender waifts and fine turned ankles would be imperfections in this part of Africa, and perhaps over all that quarter of the globe; fo great is the contraft of tafte, and fo various the prejudices of nations.

The Moors prefent their wives with jewels of gold, filver, or pearl, but very few wear precious ftones; this is a luxury of which they have little knowledge. They have rings in filver or gold; alfo ear-rings in the form of a crefcent, five inches in circumference, and as thick as the end of the little finger. They firft pierce their ears, and introduce a fmall roll of paper, which they daily increafe in thicknefs, till at length they infert the kernel of the date, which is equal in fize to the ear-ring. They wear bracelets in gold and folid filver, and filver rings at the bottom of their legs, fome of them confiderably heavy. The ufe of white paint is unknown among the Moorifh women, and that of red but little. It is much more common to fee them dye their eyebrows and eye-lafhes, which dye does not add to the beauty of the countenance, but confiderably to the fire of the eyes. They trace regular features with henna, of a faffron colour, on their feet, the palm of the hand, and the tip of their fingers.—On their vifiting day they wrap themfelves in a clean fine haick, which comes over the head, and furrounds the face fo as to let them fee without being feen.—When they travel, they wear ftraw hats to keep off the fun; and in fome parts of the empire the women wear hats on their vifits; which is a fafhion peculiar to the tribes coming from the fouth, who have preferved their cuftoms; for the Moors do not change modes they have once adopted.

The *Negroes*, who conftitute a large proportion of the emperor's fubjects, and the occafion of whofe introduction to this empire has been already mentioned, are better formed than the Moors; and as they are more lively, daring, and active, they are entrufted with an important fhare in the executive part of government. They conftitute in fact the moft confiderable part of the emperor's army, and are generally appointed to the command of provinces and towns. This circumftance naturally creates a jealoufy between them and the Moors, the latter confidering the negroes as ufurpers of a power which they have no right to affume. Befides thofe negroes which form the emperor's army, there are a great many others in the country, who either are or have been flaves to private Moors: every Moor of confequence, indeed, has his proportion of them in his fervice. To the difgrace of Europe, the Moors treat their flaves with humanity, em- 35 Negroes.

Morocco. ploying them in looking after their gardens, and in the domeftic duties of their houfes. They allow them to marry among themfelves; and after a certain number of years, fpontaneoufly prefent them with the invaluable boon of liberty. They foon are initiated in the Mahometan perfuafion, though they fometimes intermix with it a few of their original fuperftitious cuftoms. In every other refpect they copy the drefs and manners of the Moors.

36 Renegadoes. Among the inhabitants of Morocco there is another clafs, of whom we muft not omit to make mention. Thefe are the *Renegadoes*, or foreigners who have renounced their religion for the faith of Mahomet. Of thefe there are a great number who have been originally Jews: they are held in little eftimation by the Moors; and would be held in abhorrence by the Jews, if they durft freely exprefs their averfion. The families of thefe apoftates are called *Toornadis:* not having at any time married with the Moors, they ftill preferve their ancient characteriftics, and are known almoft at fight to be the progeny of thofe who formerly embraced the Mahometan religion. The Chriftian renegadoes are but few; and generally are fugitive peculators of Spain, or men fallen from power, who becaufe of their mifconduct, or in defpair, quit one unfortunate fituation for another much more deplorable.

37 Jews. The *Jews* were formerly very numerous in this empire. After being profcribed in Spain and Portugal, multitudes of them paffed over to Morocco, and fpread themfelves through the towns and over the country. By the relations they themfelves give, and by the extent of the places affigned them to dwell in, it would appear there were more than 30,000 families, of whom at prefent there is fcarcely a refidue of one-twelfth; the remainder either having changed their religion, funk under their fufferings, or fled from the vexations they endured, and the arbitrary taxes and tolls impofed upon them. The Jews poffefs neither lands nor gardens, nor can they enjoy their fruits in tranquillity: they muft wear only black; and are obliged, when they pafs near mofques, or through ftreets in which there are fanctuaries, to walk barefoot. The loweft among the Moors imagines he has a right to ill-treat a Jew; nor dares the latter defend himfelf, becaufe the koran and the judge are always in favour of the Mahometan.—Notwithftanding this ftate of oppreffion, the Jews have many advantages over the Moors: they better underftand the fpirit of trade; they act as agents and brokers, and profit by their own cunning and the ignorance of the Moors. In their commercial bargains many of them buy up the commodities of the country to fell again. Some have European correfpondents; and others are mechanics, fuch as goldfmiths, tailors, gunfmiths, millers, and mafons. More induftrious, artful, and better informed than the Moors, the Jews are employed by the emperor in receiving the cuftoms, coining the money, and in all affairs and intercourfe which the monarch has with the European merchants, as well as in all his negociations with the various European governments.

38 State of knowledge among the Moors. The Moors, who derive their language and religion from the Arabs, feem not in any manner to have participated of their knowledge. United and confounded as thofe of Morocco have been with the Moors of Spain, the latter of whom cultivated the arts and gave birth to Averroes, and many other great men, the Moors of this empire have preferved no traces of the genius of their anceftors. They have no conception of the fpeculative fciences. Education confifts merely in learning to read and write; and as the revenues of the learned are derived from thefe talents, the priefts and talbes among them are the fole depofitories of this much knowledge: the children of the Moors are taught in their fchools to read and repeat fome fixty leffons, felected from the Koran, which for the fake of œconomy are written upon fmall boards. Thefe leffons being once learned, the fcholar is fuppofed to have obtained fufficient knowledge to leave fchool: on this occafion he rides on horfeback through the city, followed by his comrades, who fing his praifes: this to him is a day of triumph; to the fcholars an incitement to emulation, a feftival for the mafter, and a day of expence for the parents; for in all countries, wherever there are feftivals and proceffions, there alfo are eating and drinking. At Fez there is fome fmall degree more of inftruction to be obtained in the fchools; and the Moors who are a little wealthy fend their children thither to have them inftructed in the Arabic language, and in the religion and laws of their country. Here fome of them alfo acquire a little tafte for poetry.

The Moors who formerly inhabited Spain gave great application to phyfic and aftronomy; and they have left manufcripts behind them which ftill remain monuments of their genius. The modern Moors are infinitely degenerate: they have not the leaft inclination to the ftudy of fcience; they know the properties of fome fimples; but as they do not proceed upon principle, and are ignorant of the caufes and effects of difeafes, they generally make a wrong application of their remedies. Their moft ufual phyficians are their talbes, their fakirs, and their faints, in whom they place a fuperftitious confidence. Aftronomy is entirely or almoft unknown to the Moors; for though they likewife wander from place to place, there are few if any among them who have a knowledge of the motion of the heavens, or who are capable from principle to direct their own courfe by obferving the courfe of the ftars. They are therefore neceffarily wholly unable to calculate eclipfes, which they always interpret to portend evil.

Superftitious people, indeed, have every where fuppofed eclipfes were fent to prefage fome calamity.—The Moors being unable to reafon on the caufes of fuch an appearance, imagine the fun or the moon are in the power of a dragon that fwallows them; and they offer up prayers that thefe luminaries may be delivered from an enemy fo cruel and voracious.

Notwithftanding the Moors have occupied themfelves little in the ftudy of aftronomy, they have been eager after aftrology. This imaginary fcience, which made fo rapid a progrefs at Rome in defpite of the edicts of the emperors, may be conceived to make ftill greater advances among a people wholly ftupid and ignorant, and ever agitated by the dread of prefent evils, or the hope of a more happy futurity. Magic, the companion of aftrology, has here alfo found its followers, and is particularly ftudied by the talbes in the fouthern parts, who fuccefsfully ufe it in impofing upon Moorifh

Morocco.

Moorifh credulity with ftrange dreams and ambiguous forebodings and prophefies.

In fhort, arts and fciences feem to be almoft unknown in Morocco; or if at all cultivated, it is only by the Jews, who indeed are the only induftrious and ingenious people in the country. The Moors in general may be confidered as exifting in the paftoral ftate, following only a few mechanical trades, and leaving every thing that requires invention to the Jews, who have likewife the principal management of their commercial and pecuniary matters; and even thofe few of the Moors who are merchants, are obliged to have Jew agents, for the purpofe of tranfacting their bufinefs.

39
Manufactures and trades.

The Moorifh manufactures are—The haick, which, as was before obferved, is a long garment compofed of white wool and cotton, or cotton and filk woven together, and is ufed by the Moors for the purpofe of covering their under drefs when they go abroad, which they do by totally wrapping themfelves in it in a carelefs but eafy manner; filk handkerchiefs of a particular kind, prepared only at Fez; filks chequered with cotton; carpeting, little inferior to that of Turkey; beautiful matting, made of the palmetto or wild palm tree; paper of a coarfe kind; cordovan, commonly called *Morocco leather;* gunpowder of an inferior nature; and long-barrelled mufkets, made of Bifcay iron. The Moors are unacquainted with the mode of cafting cannon; and therefore thofe few which are now in the country are obtained from Europeans.—The manufacture of glafs is likewife unknown to them; as indeed they make great ufe of earthen ware, and have few or no windows to their houfes, this commodity may be of lefs importance to them than many others. They make butter, by putting the milk into a goat-fkin, with its outward coat turned inwards, and fhaking it till the butter collects on the fides, when it is taken out for ufe. From this operation it proves always full of hairs, and has an infipid flavour. Their cheefe confifts merely of curds hardened and dried, and has uniformly a difagreeable tafte. The bread in fome of the principal towns, particularly at Tangier and Salee, is remarkably good, but in many other places it is coarfe, black, and heavy.

The Moors, agreeably to the Jewifh cuftom, cut the throats of all the animals they eat, at the fame time turning their heads towards Mecca, in adoration of their prophet. After fuffering them to bleed freely, they carefully wafh all the remaining blood away, and divide the meat into fmall pieces, of about one or two pounds in weight. As they are unacquainted with the invention of pumps, and have but few fprings, it affords employment to a number of indigent people, who would probably be idle otherwife, to carry water in fkins from the neareft river or refervoir, and fell it to the inhabitants. From their being obliged to tar the fkins to prevent them from leaking, the water is frequently rendered very unpleafant.

Their looms, forges, ploughs, carpenters tools, &c. are much upon the fame conftruction with the unimproved inftruments of the fame kind which are ufed at this time in fome parts of Europe, only ftill more clumfily finifhed. In their work, they attend more to ftrength than neatnefs or convenience; and, like all other ignorant people, they have no idea that what they do is capable of improvement. It is probable, indeed, that the Moors have undergone no very material change fince the revolution in their arts and fciences, which took place foon after their expulfion from Spain. Previous to that period, it is well known they were an enlightened people, at a time when the greater part of Europe was involved in ignorance and barbarifm; but owing to the weaknefs and tyranny of their princes, they gradually funk into the very oppofite extreme, and may now be confidered as but a few degrees removed from a favage ftate.

They ufe no kind of wheel-carriage; and therefore all their articles of burden are tranfported from one place to another on camels, mules, or affes. Their buildings, though by no means conftructed on any fixed principle of architecture, have at leaft the merit of being very ftrong and durable. The manner of preparing tabby, of which all their beft edifices are formed, is the only remain of their ancient knowledge at prefent exifting. It confifts of a mixture of mortar and very fmall ftones, beaten tight in a wooden cafe, and fuffered to dry, when it forms a cement equal to the folid rock. There are always unaccountable difcrepancies and inconfiftencies in the arts of uncivilized nations. The apartments are, if poffible, even more inconvenient than thofe of their neighbours the Spaniards; but the carved wood-work with which many of them are ornamented, is equal to any in Europe.

Their mofques or places of public worfhip are ufually large fquare buildings, compofed of the fame materials as the houfes. The building confifts of broad and lofty piazzas, opening into a fquare court, in a manner in fome degree fimilar to the Royal Exchange of London. In the centre of the court is a large fountain, and a fmall ftream furrounds the piazzas, where the Moors perform the ceremony of ablution. The court and piazzas are floored with blue and white chequered tiling, and the latter are covered with matting, upon which the Moors kneel while repeating their prayers. In the moft confpicuous part of the mofque, fronting the eaft, ftands a kind of pulpit, where the talbe or prieft occafionally preaches. The Moors always enter this place of worfhip bare-footed, leaving their flippers at the door. On the top of the mofque is a fquare fteeple with a flag-ftaff, whither at ftated hours the talbe afcends, hoifts a white flag, and calls the people to prayers, for they have no bells. From this high fituation the voice is heard at a confiderable diftance; and the talbes have a monotonous mode of enunciation, the voice finking at the end of every fhort fentence, which in fome meafure refembles the found of a bell. The moment the flag is difplayed, every perfon forfakes his employment, and goes to prayers. If they are near a mofque, they perform their devotions within it, otherwife immediately on the fpot where they happen to be, and always with their faces towards the eaft, in honour of their prophet Mahomet, who it is well known was buried at Medina. The prayer which is generally repeated on thefe occafions, is a chapter from the Koran, acknowledging the goodnefs of God and Mahomet; and it is accompanied with various geftures, such as lifting the hands above the head, bowing twice, performing two genuflexions,

40
Religious ceremonies.

Morocco.

nuflexions, bowing again twice, and kiſſing the ground. The whole of this ceremony they repeat three times.

Their ſabbath is on our Friday, and commences from ſix o'clock the preceding evening. On this day they uſe a blue flag inſtead of the white one. As it has been propheſied that they are to be conquered by the Chriſtians on the ſabbath-day, the gates of all the towns and of the emperor's palaces are ſhut when at divine ſervice on that day, in order to avoid being ſurpriſed during that period. Their talbes are not diſtinguiſhed by any particular dreſs.

The Moors have three ſolemn devotional periods in the courſe of the year. The firſt, which is named *Aid de Cabier*, is held in commemoration of the birth of Mahomet. It continues ſeven days; during which period, every perſon who can afford the expence kills a ſheep as a ſacrifice, and divides it among his friends. The ſecond is the *Ramadam*. This is held at the ſeaſon when Mahomet diſappeared in his flight from Mecca to Medina. Every man is obliged at that period to faſt (that is, to abſtain from animal-food from ſunriſe to ſun-ſet each day) for 30 days; at the expiration of which time a feaſt takes place, and continues a week. The third is named *Llaſhore*, and is a day ſet apart by Mahomet for every perſon to compute the value of his property, in order for the payment of *zakat*, that is, one-tenth of their income to the poor, and other pious uſes. Although this feaſt only laſts a ſingle day, yet it is celebrated with far greater magnificence than either of the others.

The Moors compute time by lunar months, and count the days of the week by the firſt, ſecond, third, &c. beginning from our Sunday. They uſe a common reed for writing, and begin their manuſcripts from right to left.

41 Language of the Moors.

The Moors of the empire of Morocco, as well as thoſe to the northern limits of Africa, ſpeak Arabic; but this language is corrupted in proportion as we retire farther from Aſia, where it firſt took birth; the intermixture which has happened among the African nations, and the frequent tranſmigrations of the Moors, during a ſucceſſion of ages, have occaſioned them to loſe the purity of the Arabic language; its pronunciation has been vitiated, the uſe of many words loſt, and other foreign words have been introduced without thereby rendering it more copious; the pronounciation of the Africans, however, is ſofter to the ear and leſs guttural than that of the Egyptians. The language, when written, is in effect much the ſame at Morocco as at Cairo, except that there are letters and expreſſions among the Moors which differ from thoſe of the Oriental Arabs, who, however, underſtand the Moors in converſation, notwithſtanding their vitiated manner of pronouncing. They mutually read each others writings with ſome difficulty.

There is a very ſenſible difference among the Moors between the Arabic of the learned and the courtiers, and that ſpoken by the people in general; and this difference is felt ſtill more in the provinces of the ſouth or of the eaſt, and among the Moors who live in the deſarts, where the Arabic is yet farther diſfigured by a mixture of foreign tribes.

The Brebes and the Shellu, who appear to have had the ſame origin, for they have preſerved the ſame dialect, ſpeak a language which the Moors do not underſtand, and which ſeems to have no analogy with that of the latter. It has been conjectured to be the Punic, or the Numidian; but theſe people write it in Arabic characters. The Brebes count the days of the week like the Moors, and both of them employ Arabic words. The Shellu enumerate the days after the ſame method, but in their own language. Both the Brebes and the Shellu denote the months of the year in the ſame manner as do the Moors and Arabs, and date from the ſame æra; that is to ſay, from the year of the Hegira.

The Koran and books of prayer of the Brebes and Shellu are in Arabic; as likewiſe are their acts and title-deeds, which are written by their talbes or learned men.

42 Their temper and diſpoſition.

The Moors are naturally of a grave and penſive diſpoſition, fervid in profeſſions of friendſhip, but very inſincere in their attachments. They have no curioſity, no ambition of knowledge; an indolent habit, united to the want of mental cultivation, renders them perhaps even more callous than other unenlightened people to every delicate ſenſation; and they require more than ordinary excitement to render them ſenſible of pleaſure or of pain. This languor of ſentiment is, however, unaccompanied with the ſmalleſt ſpark of courage or fortitude. When in adverſity, they manifeſt the moſt abject ſubmiſſion to their ſuperiors; and in proſperity their tyranny and pride is inſupportable. They frequently ſmile, but ſeldom are heard to laugh loud. The moſt infallible mark of internal tranquillity and enjoyment is when they amuſe themſelves with ſtroking or playing with their beard. When rouſed by reſentment, their diſputes rarely proceed further than violently to abuſe each other in the moſt opprobrious language. They never fight or box with their fiſts like our peaſantry; but when a quarrel proceeds to great extremities, they collar each other, and ſometimes terminate a diſpute by aſſaſſination.

43 Mode of living, manners, &c.

Perſonal cleanlineſs has been conſidered as one of thoſe circumſtances which ſerve to mark and determine the civilization of a people. It was in vain that Mahomet enjoined the frequency of ablution as a religious duty to the Moors. Their dreſs, which ſhould be white, is but ſeldom waſhed; and their whole appearance evinces that they perform this branch of their religious ceremonies in but a ſlovenly manner. With this degree of negligence as to their perſons, we may be juſtly ſurpriſed to find united a moſt ſcrupulous nicety in their habitations and apartments. They enter their chambers barefooted, and cannot bear the ſlighteſt degree of contamination near the place where they are ſeated. This delicacy again is much confined to the inſides of their houſes. The ſtreets receive the whole of their rubbiſh and filth; and by theſe means the ground is ſo raiſed in moſt parts of the city of Morocco, that the new buildings always ſtand conſiderably higher than the old.

When a Moor receives his gueſts, he never riſes from his ſeat, but ſhakes hands, inquires after their health, and deſires them to ſit down, either on a carpet or a cuſhion placed on the floor for that purpoſe. Whatever be the time of day, tea is then brought in on a tea-board with ſhort feet. This is the higheſt com-

Morocco. compliment that can be offered by a Moor; for tea is a very expenfive and fcarce article in Barbary, and is only drank by the rich and luxurious. Their manner of preparing it is by putting fome green tea, a fmall quantity of tanfey, the fame portion of mint, and a large proportion of fugar (for the Moors drink their tea very fweet) into the tea-pot at the fame time, and filling it up with boiling water. When thefe articles are infufed a proper time, the fluid is then poured into remarkably fmall cups of the beft India china, the fmaller the more genteel, without any milk; and accompanied with fome cakes or fweetmeats, it is handed round to the company. From the great efteem in which this beverage is held by the Moors, it is generally drank by very fmall and flow fips, that its flavour may be the longer enjoyed; and as they ufually drink a confiderable quantity whenever it is introduced, this entertainment is feldom finifhed in lefs time than two hours.

The other luxuries of the Moors are fnuff, of which they are uncommonly fond, and fmoking tobacco, for which the greater part ufe wooden pipes about four feet in length, with an earthen bowl; but the princes or emperor generally have the bowls made of folid gold. Inftead of the indulgence of opium, which, from the heavy duty impofed upon that article by the emperor, is too expenfive to be ufed by the Moors, they fubftitute the *achicha*, a fpecies of flax. This they powder and infufe in water in fmall quantities. The Moors affert, that it produces agreeable ideas; but own, that when it is taken to excefs it moft powerfully intoxicates. In order to produce this effect, they likewife mix with their tobacco an herb named in this country *khaf*, which by fmoking occafions all the inebriating effects of the *achicha*. The ufe of fpirits as well as wine is ftrictly forbidden by the Koran; there are, however, very few among the Moors who do not joyfully embrace every private opportunity of drinking both to excefs.

With refpect to the hours for eating, the people of this country are remarkably regular. Very foon after day-break they take their breakfaft, which is generally a compofition of flour and water boiled thin, together with an herb which gives it a yellow tinge. The male part of the family eat in one apartment and the female in another. The children are not permitted to eat with their parents, but take their meals afterwards with the fervants; indeed in moft other refpects they are treated exactly as fervants or flaves by their parents. The mefs is put into an earthen bowl, and brought in upon a round wooden tray. It is placed in the centre of the guefts, who fit crofs-legged either on a mat or on the floor, and who form a circle for the purpofe. Having previoufly wafhed themfelves, a ceremony always performed before and after meals, each perfon with his fpoon attacks vigoroufly the bowl, while they diverfify the entertainment by eating with it fruit or bread. At 12 o'clock they dine, performing the fame ceremonies as at breakfaft. For dinner, from the emperor down to the peafant, their difh is univerfally *coofcoofoo*, the mode of preparing which has been already defcribed. The difh is brought in upon a round tray and placed on the floor, round which the family fit as at breakfaft, and with their fingers commit a violent affault on its contents: they are at the fame time, however, attended by a flave or domeftic, who prefents them with water and a towel occafionally to wafh their hands. From the want of the fimple and convenient invention of knives and forks, it is not uncommon in this country to fee three or four people pulling to pieces the fame piece of meat, and afterwards with their fingers ftirring up the pafte or *coofcoofoo*, of which they often take a whole handful at once into their mouth. At fun-fet they fup upon the fame difh; and indeed fupper is their principal meal.

Such is the general mode of living among the principal people in towns. There are confiderable multitudes, however, who do not fare fo well, but are obliged to content themfelves with a little bread and fruit inftead of animal food, and to fleep in the open ftreets. This kind of exiftence feems ill calculated to endure even in an inactive ftate; far more fevere muft it therefore be to thofe who exercife the laborious employment of couriers in this country, who travel on foot a journey of 300 or 400 miles at the rate of between 30 or 40 miles a-day, without taking any other nourifhment than a little bread, a few figs, and fome water, and who have no better fhelter at night than a tree. It is wonderful with what alacrity and perfeverance thefe people perform the moft fatiguing journeys at all feafons of the year. There is a regular company of them in every town, who are ready to be difpatched at a moment's warning to any part of the country their employers may have occafion to fend them. They conftitute in this empire the only mode of conveyance for all public and private difpatches; and as they are well known in the place to which they belong, they are very punctual in delivering every thing that is put into their hands. From their fteady pace in travelling, at the rate of about four miles an hour, and from their being able to pafs over parts which from the mountainous ftate of the country, and from the want of good roads, perfons on horfeback would find inacceffible, they are indeed by far the moft expeditious meffengers that could be employed.

As none but the very vulgar go on foot in this country, for the purpofe of vifiting mules are confidered as more genteel than horfes; and the greateft pride of a Moor is to have fuch as walk remarkably faft, and to keep his footmen, of which the number is proportionable to the rank and confequence of the mafter, on a continued run.

As the Moors are not fond of admitting men into their houfes except upon particular occafions, if the weather is fine they place a mat, and fometimes a carpet, on the ground before their door, feat themfelves upon it crofs-legged, and receive their friends, who form a circle, fitting in the fame manner, with their attendants on the outfide of the groupe. Upon thefe occafions they either drink tea or fmoke and converfe. The ftreets are fometimes crowded with parties of this kind; fome engaged in playing at an inferior kind of chefs or drafts, at which they are very expert; but the majority in converfation. The people of this country, indeed, are fo decidedly averfe to ftanding up, or walking about, that if only two or three

Morocco. three people meet, they ſquat themſelves down in the firſt clean place they can find, if the converſation is to hold but for a few minutes.

The manner of ſalutation among the Moors is, when too equals meet, by a quick motion they ſhake hands, and afterwards kiſs each other's hand. When an inferior meets a ſuperior, ſuch as an officer of rank, a judge, or governor, he kiſſes that part of his haick which covers the arm; and ſometimes, as a higher mark of reſpect, he will kiſs his feet. But the compliment due to the emperor, or any of the princes of the blood, is to take off the cap or turban, and to proſtrate the head to the ground. When two particular friends or relations meet, they anxiouſly embrace and kiſs each other's faces and beards for a few minutes, make a number of enquiries about the health of each party, as well as that of their families, but ſeldom allow time for a reply.

44 Their amuſements. The Moors have in general but few amuſements; the ſedentary life they lead in cities is little variegated except by the care they take of their gardens, which are rather kept for profit than pleaſure. Moſt of theſe gardens are planted with the orange, the lemon tree, and the cedar, in rows, and in ſuch great quantities, that the appearance is rather that of a foreſt than that of a garden. The Moors ſometimes, though rarely, have muſic in theſe retreats: a ſtate of ſlavery but ill agrees with the love of pleaſure: the people of Fez alone, either from a difference in education, or becauſe their organs and ſenſibility are more delicate, make muſic a part of their amuſements. There are not in Morocco, as in Turkey, public coffee-houſes, where people meet to enquire the news of the day; but inſtead of theſe, the Moors go to the barbers ſhops, which in all countries ſeem to be the rendezvous of newſmongers. Theſe ſhops are ſurrounded by benches; on which the cuſtomer, the inquiſitive, and the idle, ſeat themſelves and when there are no more places vacant, they crouch on the ground like monkeys.

Showmen and dancers come often into the towns; round whom the people aſſemble and partake of the amuſement for a very trifle. There are alſo a kind of wandering hiſtorians: the vulgar, who cannot read, and who every where are eager to hear extraordinary relations, are the more aſſiduous in attending theſe narrators, as want of more extenſive information prevents the tale-teller remaining above a week in a place.

A common diverſion in the towns where there are ſoldiers, as well as in the country, is what the Moors call the game of gun-powder; a kind of military exerciſe that is the more pleaſing to theſe people, inaſmuch as, by the nature of their government, they all are, or are liable to become, ſoldiers, therefore all have arms and horſes. By exploſions of powder, too, they manifeſt their feſtivity on their holidays. Their game of gun powder conſiſts in two bodies of horſe, each at a diſtance from the other, galloping in ſucceſſive parties of four and four, and firing their pieces charged with powder. Their chief art is in galloping up to the oppoſite detachment, ſuddenly ſtopping, firing their muſkets, facing about, charging, and returning to the attack; all which manœuvres are imitated by their opponents. The Moors take great pleaſure in this amuſement, which is only an imitation of their military evolutions. Morocco.

45 Management of horſes. The common topics for converſation among the Moors, are the occurrences of the place, religion, their women, but above all their horſes. This laſt topic, indeed, appears to occupy by far the greateſt portion of their attention. Theſe animals are ſeldom kept in ſtables in Morocco. They are watered and fed only once a-day, the former at one o'clock at noon, and the latter at ſun-ſet; and the only one mode which they uſe to clean them is by waſhing them all over in a river two or three times a week, and ſuffering them to dry themſelves.

Notwithſtanding the attachment which the Moors manifeſt to their horſes, they moſt certainly uſe them with great cruelty. Their higheſt pleaſure, and one of their firſt accompliſhments, is, by means of long and ſharp ſpurs, to make the horſe go full ſpeed, and then to ſtop him inſtantaneouſly; and in this they certainly manifeſt uncommon dexterity. The iron-work of their bridles is ſo conſtructed, that by its preſſure on the horſe's tongue and lower jaw, with the leaſt exertion of the rider, it fills his mouth full of blood; and if not uſed with the utmoſt caution, throws him inevitably on his back. The bridle has only a ſingle rein, which is ſo very long, that it ſerves the purpoſe of both whip and bridle. The Mooriſh ſaddle is in ſome degree ſimilar to the Spaniſh, but the pummel is ſtill higher and more peaked. Their ſtirrups, in which they ride very ſhort, are ſo formed as to cover the whole of the foot. They either plate or gild them, according to the dignity, opulence, or fancy of the poſſeſſor. Their ſaddles, which are covered with red woollen cloth, or if belonging to a perſon of conſequence with red ſattin or damaſk, are faſtened with a ſtrong girth round the body in the European ſtyle, and another round the ſhoulders. The Moors frequently amuſe themſelves by riding with the utmoſt apparent violence againſt a wall; and a ſtranger would conceive it impoſſible for them to avoid being daſhed to pieces, when juſt as the horſe's head touches the wall, they ſtop him with the utmoſt accuracy.

46 Love of muſic. Like all barbarous nations, the Moors are paſſionately fond of muſic, and ſome few have a taſte for poetry. Their ſlow airs, for want of that variety which is introduced when the ſcience has attained a degree of perfection, have a very melancholy ſameneſs; but ſome of their quick tunes are beautiful and ſimple, and partake in ſome degree of the characteriſtic melody of the Scotch airs. The poetry of their ſongs, the conſtant ſubject of which is love, though there are few nations perhaps who are leſs ſenſible of that paſſion, has certainly leſs merit than the muſic.

Their inſtruments are a kind of hautboy, which differs from ours only in having no keys; the mandoline, which they have learnt to play upon from their neighbours the Spaniards; another inſtrument, bearing ſome reſemblance to a violin, and played upon in a ſimilar manner, but with only two ſtrings; the large drum, the common pipe, and the tabor. Theſe united, and accompanied with a certain number of voices, upon many occaſions form a band, though ſolo muſic is more common in this unſocial country. Upon all days of rejoicing, this kind of muſic, repeated volleys of muſketry, either by men on horſeback or on foot, and

Morocco. and in the evening a grand attack upon the coofcoofo, conftitute the principal part of the public entertainments.

The Moors marry very young, many of their females not being more than 12 years of age at their nuptials. As Mahometans, it is well known that their religion admits of polygamy to the extent of four wives, and as many concubines as they pleafe; but if we except the very opulent, the people feldom avail themfelves of this indulgence, fince it entails on them a vaft additional expence in houfe-keeping, and in providing for a large family. In contracting marriage, the parents of both parties are the only agents;
47 and the intended bride and bridegroom never fee each
Marriage ceremonies. other till the ceremony is performed. The marriage-fettlements are made before the cadi, and then the friends of the bride produce her portion, or if not, the hufband agrees to fettle a certain fum upon her in cafe he fhould die, or divorce her on account of barrennefs, or any other caufe. The children of the wives have all an equal claim to the effects of the father and mother, but thofe of the concubines can each only claim half a fhare.

When the marriage is finally agreed upon, the bride is kept at home eight days, to receive her female friends, who pay congratulatory vifits every day. At the fame time a talbe attends upon her, to converfe with her relative to the folemn engagement on which fhe is about to enter: on thefe occafions he commonly accompanies his admonitions with finging a pious hymn, which is adapted to the folemnity. The bridegroom, on the other hand, receives vifits from his male friends in the morning, and in the evening rides through the town accompanied by them, fome playing on hautboys and drums, while others are employed in firing volleys of mufketry. In all their feftivals, the difcharge of mufketry indeed forms a principal part of the entertainment. Contrary to the European mode, which particularly aims at firing with exactnefs, the Moors difcharge their pieces as irregularly as poffible, fo as to have a continual fucceffion of reports for a few minutes.

On the day of the marriage, the bride in the evening is put into a fquare or octagonal cage about 12 feet in circumference, which is covered with fine white linen, and fometimes with gauzes and filks of various colours. In this vehicle, which is placed on a mule, fhe is paraded round the ftreets, accompanied by her relations and friends, fome carrying lighted torches, others playing on the hautboys, and a third party again firing volleys of mufketry. In this manner fhe is carried to the houfe of her intended hufband, who returns about the fame time from performing fimilar ceremonies. On her arrival, fhe is placed in an apartment by herfelf, and her hufband is introduced to her alone for the firft time, who finds her fitting on a filk or velvet cufhion, fuppofing her to be a perfon of confequence, with a fmall table before her, upon which are two wax candles lighted. Her fhift, or more properly fhirt, hangs down like a train behind her, and over it is a filk or velvet robe with clofe fleeves, which at the breaft and wrifts is embroidered with gold; this drefs reaches fomething lower than the calf of the leg. Round her head is tied a black filk fcarf, which hangs behind as low as the ground. Thus attired, the bride fits with her hands over her eyes, when her hufband appears and receives her as his wife without any further ceremony: for the agreement made by the friends before the cadi is the only fpecific contract which is thought neceffary.

If the hufband fhould have any reafon to fufpect that his wife has not been ftrictly virtuous, he is at liberty to divorce her and take another. For fome time after marriage, the family and the friends are engaged in much feafting, and a variety of amufements, which laft a longer or fhorter time according to the circumftances of the parties. It is ufually cuftomary for the man to remain at home eight days and the woman eight months after they are firft married; and the woman is at liberty to divorce herfelf from her hufband, if fhe can prove that he does not provide her with a proper fubfiftence. If he curfes her, the law obliges him to pay her, for the firft offence eight ducats; for the fecond, a rich drefs of ftill greater value; and the third time fhe may leave him entirely. He is then at liberty to marry again in two months.

Women fuffer but little inconvenience in this country from child-bearing; they are frequently up the next day, and go through all the duties of the houfe 48
with the infant upon their backs. In celebrating the Circumcifion.
rite of circumcifion, the child is dreffed very fumptuoufly, and carried on a mule, or, if the parents are in poor circumftances, on an afs, accompanied with flags flying and muficians playing on hautboys and beating drums. In this manner they proceed to the 49
mofque, where the ceremony is performed. Children, Education of children.
as foon as they can be made in the leaft degree ufeful, are put to the various kinds of labour adapted to their age and ftrength. Others, whofe parents are in better circumftances, are fometimes fent to fchool; and thofe who are intended for the church, ufually continue their ftudies till they have nearly learnt the Koran by rote. In that cafe they are enrolled among the talbes, or learned men of the law; and upon leaving fchool are paraded round the ftreets on a horfe, accompanied by mufic and a large concourfe of people.

When any perfon dies, a certain number of women 50 Funeral rites.
are hired for the purpofe of lamentation; in the performance of which, nothing can be more grating to the ear, or more unpleafant, than their frightful moans, or rather howlings: at the fame time, thefe mercenary mourners beat their heads and breafts, and tear their cheeks with their nails. The bodies are ufually buried a few hours after death. Previous to interment, the corpfe is wafhed very clean, and fewed up in a fhrowd, with the right hand under the head, which is pointed towards Mecca: it is carried on a bier fupported upon mens fhoulders, to the burying place, which is always, with great propriety, on the outfide of the town, for they never bury their dead in the mofques, or within the bounds of an inhabited place. The bier is accompanied by numbers of people, two a-breaft, who walk very faft, calling upon God and Mahomet, and finging hymns adapted to the occafion. The grave is made very wide at the bottom and narrow at the top, and the body is depofited without any other ceremony than finging and praying in the fame manner as on their way to the grave. They have no tombs in this country, but long and plain ftones; and it is frequently cuftomary for the female friends

Morocco. friends of the departed to weep over their graves for feveral days after their funeral.

51 Abfurd conduct of the European powers towards Morocco.

It has often been thought furprifing, that the Chriftian powers fhould fuffer their marine to be infulted by thofe barbarians, who take the fhips of all nations with whom they are not at peace, or rather who do not pay them a fubfidy either in money or commodities. This forbearance has been accounted for no otherwife than by fuppofing, firft, that a breach with them might provoke the Porte, who pretends to be their lord paramount; fecondly, that no Chriftian power would be fond of feeing Algiers, and the reft of that coaft, in poffeffion of another; and, thirdly, that nothing could be got by a bombardment of any of their towns, as the inhabitants would inftantly carry their effects to their deferts and mountains, fo that the benefit refulting from the conqueft muft be tedious and uncertain.

The firft reafon is fo obvioufly abfurd as to require no anfwer. In regard to the fecond and third fuppofitions, it may be obferved, that there is no neceffity for taking poffeffion of thofe coafts by any European power whatever. The object ought to be, not to conquer, but to render impotent, thofe piratical ftates; not to profit by plundering them, but to quafh their piracies, and prevent them from being longer the nuifances and pefts of the Mediterranean. Than which, according to the beft informed travellers, there can be nothing more eafy. Hardly any force of armament would be neceffary for the purpofe, would the Europeans merely leave them to their own refources, and with-hold thofe fupplies with which they have been in ufe to furnifh them, contrary as well to good policy as to the interefts of humanity. M. Lempriere †, fpeaking of the emperor of Morocco (1790) obferves, that "nothing but grofs neglect or inexcufable ignorance could induce the European princes in general to remain in a kind of tributary ftate to a prince who had neither an army nor a fleet which deferved the name, and a people whofe difpofition is lefs fuited to enterprife than perhaps any other. What had they to fear from him? His whole fleet confifted only of a few fmall frigates and row-boats, ill managed and worfe manned, the whole of which might have been deftroyed in one day by two or three well appointed European frigates. The entrances of thofe ports where he laid up his fhipping, if we except Tangier and Larache, are fo continually choaking up with fand, that in a fhort time they will only admit fifhing-boats, or the very fmalleft craft. The towns are none of them regularly fortified except Mogodore, and that hardly produces half a dozen of men who underftand the leaft of working the guns. And yet this contemptible power gives laws to all the coafts of Portugal and Spain, and may be faid in fome meafure to command the entrance of the Mediterranean.

† *Tour*, p. 233.

"It may be faid, he was too trifling a power to notice; if fo, why lavifh immenfe prefents for the purpofe of keeping him in temper? Thofe who imagined they fecured his friendfhip by thefe means, were much miftaken; on the contrary, they only added fuel to that flame of avarice which was not to be extinguifhed. If he was one day prefented with a frigate, he afked for two the next; and the more his requefts were indulged, the more his inordinate defires were increafed. It is well known to thofe who have been converfant with the Moors, that to fecure their friendfhip, you muft firft affert your own fuperiority; and then if you make them a trifling prefent, its value is trebled in their eftimation. The fame difpofition would have been found in the late emperor as in the common Moor. So far from courting an alliance, it would rather have been good policy at once to quarrel with him; the lofs of a few towns, and particularly Mogodore, to which he was much attached, from its being raifed under his own aufpices, would foon have reduced him to good humour and fubmiffion."

Another intelligent traveller, M. Briffon *, obferves how extraordinary it is, that a prince fo little to be dreaded as the emperor of Morocco fhould oblige the different powers of Europe to fend ambaffadors to him, and that he fhould even dictate laws to them. There is not a fingle fovereign who dares to fend a reprefentative to his court without making him at the fame time confiderable prefents; and what envoy would prefent himfelf without having his hands full? How happens it that the confuls have not, by common confent, reprefented to their refpective fovereigns, that the emperor of Morocco becomes every day more and more powerful by the fupplies which they themfelves furnifh him? Twenty years ago this prince was abfolutely deftitute of refources. He had neither materials nor any place for cafting cannons; and he was equally in want of wood for building fhips, of ropes, of nails, and even of workmen. It is France and other European powers that affift him, elfe the emperor of Morocco would be of little confideration. His fuperb batteries of brafs cannons, 24, 36, and 48 pounders, were furnifhed by Holland, Spain, England, and France. England has done more than other nations, by felling him thofe beautiful cannons which were taken on the floating batteries. Mogodore is built in an advantageous fituation, its batteries are well difpofed, and there are cannon at each embrafure; but they are there only in a manner for fhow, as they have no carriages, and are fupported only by brick-work. There are no workmen in the country capable of mounting them on carriages, nor is there wood proper for making them. Did a few veffels only wait for the failing of thofe fmall frigates, which are almoft all unfit for fea except only two, nothing would be eafier than to prevent them from returning, and to block up the ports of Mogodore, Rabat, and Salee. What would become of his commerce, and above all his marine, did the Chriftian princes ceafe to affift him, contrary to the interefts of humanity? Would England and Spain unite only for a moment, Tangiers, his moft beautiful port, would foon be fo far ruined, that it could not afford fhelter to his fubjects, who, deftitute of fhips, would foon be obliged to give over their piracies. If the confuls of different nations have never made thefe obfervations, and if they have never pointed out the means of curbing the infolence of the emperor of Morocco, it is becaufe they are at the head of the commerce which thefe different powers carry on in that part of the world. I can pofitively affert, that thefe reprefentatives, inftead of furnifhing their courts with the means of diminifhing the power of the emperor, never ceafe to add to his ftrength, and to incite him to make

* *Shipwreck of M. Briffon.*

52 Avarice and intrigues of their confuls.

 new

Morocco. new pretenſions. How much we aſſiſt theſe pirates, to hurt the advantageous trade which we might carry on! Their ſituation renders them very dangerous; but if we leave them only their ſituation, it would be impoſſible for them to profit much by it. Let impartial people pay a viſit to that country, let them ſpeak with the ſame ſincerity as I do; and they will no doubt be convinced, that the emperor of Morocco, of all the princes in the world, would be the leaſt able to do miſchief, did the ſovereigns of Europe ceaſe to furniſh him with ſuccours."

53 Deſcription of the city of Morocco.

Morocco, a city of the kingdom of Morocco in Barbary, lying about 120 miles to the north of Tarudant, 90 to the eaſt of Mogodore, and 350 to the ſouth of Tangier. It is ſituated in a beautiful valley, formed by a chain of mountains on the northern ſide, and thoſe of the Atlas, from which it is diſtant about 20 miles on the ſouth and eaſt. The country which immediately ſurrounds it is a fertile plain, beautifully diverſified with clumps of palm trees and ſhrubs, and watered by ſmall and numerous ſtreams which deſcend from Mount Atlas. The emperor's out-gardens, which are ſituated at the diſtance of about five miles to the ſouth of the city, and are large plantations of olives walled in, add conſiderably to the beauty of the ſcene.

Morocco, though one of the capitals of the empire (for there are three, Morocco, Mequinez, and Fez), has nothing to recommend it but its great extent and the royal palace. It is encloſed by remarkably ſtrong walls built of tabby, the circumference of which is about eight miles. On theſe walls there are no guns mounted; but they are flanked with ſquare towers, and ſurrounded by a wide and deep ditch. The city has a number of entrances, conſiſting of large double porches of tabby in the Gothic ſtyle, the gates of which are regularly ſhut every night at certain hours. As polygamy is allowed by the Mahometan religion, and is ſuppoſed in ſome degree to affect population, it would be difficult to form any computation near the truth with reſpect to the number of inhabitants which this city may contain. The moſques, which are the only public buildings except the palace worth noticing at Morocco, are more numerous than magnificent; one of them is ornamented with a very high and ſquare tower, built of cut ſtone, which is viſible at a conſiderable diſtance from the city. The ſtreets are very narrow, dirty, and irregular, and many of the houſes are uninhabited and falling to ruin. Thoſe which are decent and reſpectable in their appearance are built of tabby, and encloſed in gardens. That of the effendi or prime miniſter (according to Mr Lempriere, from whoſe *Tour* * this account is tranſcribed), was among the beſt in Morocco. This houſe, which conſiſted of two ſtories, had elegant apartments both above and below, furniſhed in a ſtyle far ſuperior to any thing our author ever ſaw in that country. The court, into which the lower aparments opened, was very neatly paved with glazed blue and white tiling, and had in its centre a beautilful fountain. The upper apartments were connected together by a broad gallery, the balluſters of which were painted of different colours. The hot and cold baths were very large, and had every convenience which art could afford. Into the garden, which was laid out in a tolerably neat ſtyle, opened a room adjoining to the houſe, which had a broad arched entrance but no door, beautifully ornamented with chequered tiling; and at both ends of the apartment the walls were entirely covered with looking-glaſs. The flooring of all the rooms was covered with beautiful carpeting, the walls ornamented with large and valuable looking-glaſſes, intermixed with watches and clocks in glaſs-caſes. The ceiling was carved woodwork, painted of different colours; and the whole was in a ſuperior ſtyle of Mooriſh grandeur. This and a few others are the only decent habitations in Morocco. The generality of them ſerve only to impreſs the traveller with the idea of a miſerable and deſerted city.

* Publiſhed in 1791.

The Elcaiſſeria is a particular part of the town where ſtuffs and other valuable articles are expoſed to ſale. It conſiſts of a number of ſmall ſhops, formed in the walls of the houſes, about a yard from the ground, of ſuch an height within as juſt to admit a man to ſit in one of them croſs-legged. The goods and drawers are ſo arranged round him, that when he ſerves his cuſtomers, who are ſtanding all the time out in the ſtreet, he can reach down any article he wants without being under the neceſſity of moving. Theſe ſhops, which are found in all the other towns of the empire, are ſufficient to afford a ſtriking example of the indolence of the Moors. There are three daily markets in different parts of the town of Morocco where proviſions are ſold, and two weekly fairs or markets for the diſpoſal of cattle. The city is ſupplied with water by means of wooden pipes connected with the neighbouring ſtreams, which empty themſelves into reſervoirs placed for the purpoſe in the ſuburbs, and ſome few in the centre of the town.

The caſtle is a large and ruinous building, the outer walls of which encloſe a ſpace of ground about three miles in circumference. It has a moſque, on the top of which are three large balls, formed, as the Moors allege, of ſolid gold. The caſtle is almoſt a town of itſelf; it contains a number of inhabitants, who in ſome department or other are in the ſervice of the emperor, and all under the direction of a particular alcaide, who is quite independent of the governor of the town. On the outſide of the caſtle, between the Mooriſh town and the Jewdry, are ſeveral ſmall diſtinct pavilions, incloſed in gardens of orange-trees, which are intended as occaſional places of reſidence for ſuch of the emperor's ſons or brothers as happen to be at Morocco. As they are covered with coloured tiling, they have at a ſmall diſtance rather a neat appearance; but upon approaching or entering them, that effect in a great meaſure ceaſes.

The Jews, who are at this place pretty numerous, have a ſeparate town to themſelves, walled in, and under the charge of an alcaide, appointed by the emperor. It has two large gates, which are regularly ſhut every evening about nine o'clock; after which time no perſon whatever is permitted to enter or go out of the Jewdry till they are opened again the following morning. The Jews have a market of their own; and when they enter the Mooriſh town, caſtle, or palace, they are always compelled to be barefooted.

The palace is an ancient building, ſurrounded by a ſquare wall, the height of which nearly excludes from the view of the ſpectator the other buildings. Its principal gates are conſtructed with Gothic arches,

 compoſed

compofed of cut ftone, which conduct to feveral open and fpacious courts; through thefe it is neceffary to pafs before we reach any of the buildings. Thefe open courts were ufed by the late emperor for the purpofes of tranfacting public bufinefs and exercifing his troops. The habitable part confifts of feveral irregular fquare pavilions, built of tabby, and whitened over; fome of which communicate with each other, others are diftinct, and moft of them receive their names from the different towns of the empire. The principal pavilion is named by the Moors the *douhar*, and is more properly the palace or feraglio than any of the others. It confifts of the emperor's place of refidence and the Harem, forming altogether a building of confiderable extent. The other pavilions are merely for the purpofes of pleafure or bufinefs, and are quite diftinct from the douhar. The *Mogodore* pavilion, fo named from the late emperor's partiality to that town, has by far the faireft claim to grandeur and magnificence. This apartment was the work of Sidi Mahomet, and is lofty and fquare. It is built of cut ftone, handfomely ornamented with windows, and covered with varnifhed tiles of various colours; and its elegance and neatnefs, contrafted altogether with the fimplicity and irregularity of the other buildings, produce a moft ftriking effect. In the infide, befides feveral other apartments, we find in the pavilion a fpacious room floored with blue and white chequered tiling, its ceiling covered with curioufly carved and painted wood, and its ftuccoed walls varioufly ornamented with looking-glaffes and watches, regularly difpofed in glafs-cafes. To this pavilion the late emperor manifefted an exclufive preference, frequently retiring to it both for the purpofes of bufinefs and of recreation. The apartments of the emperor have in general a much fmaller complement of furniture than thofe of the Moors in the inferior walks of life. Handfome carpeting, a mattrafs on the ground covered with fine linen, a couch, and a couple of European bedfteads, are the principal articles they contain. The gardens within the walls of the palace, of which he has feveral, are very neat; they contain orange and olive trees, varioufly difpofed and arranged, and interfected with ftreams of water, fountains, and refervoirs. Thofe on the outfide are nothing more than large tracts of ground, irregularly planted with olives; having four fquare walks, and furrounded by walls.

MOROCCO, or *Marroquin*, the fkin of a goat, or fome other animal refembling it, dreffed in fumac or galls, and coloured of any colour at pleafure; much ufed in bookbinding, &c. The name is ordinarily derived from the kingdom of Morocco, whence it is fuppofed the manner of preparing thefe fkins was firft borrowed. We have Morocco fkins brought from the Levant, Barbary, Spain, Flanders, and France; red, black, yellow, blue, &c. For the manner of preparing them, fee LEATHER.

MOROCHTHUS, in natural hiftory, an indurated clay called by us *French chalk;* ferving taylors and others to mark with. The ancients efteemed it as an aftringent, prefcribing it in the colic, hæmorrhagies, and other fluxes.

MORON, a town of Spain, in Andalufia, feated in a pleafant fertile plain, and in the neighbourhood is a mine of precious ftones. It is 30 miles fouth-eaft of Seville. W. Long. 5. 20. N. Lat. 37. 0.

MORPETH, a handfome town of Northumberland, 14 miles from Newcaftle, 286 miles from London, is an ancient borough by prefcription, with a bridge over the Wanfbeck. It had once an abbey and a caftle, now in ruins, fituated about a quarter of a mile fouth of the town and river Wanfbeck, on an eminence which overlooks them both. The market-place is conveniently fituated near the centre of the town; and an elegant town-houfe was built by the Carlifle family in 1714, in which the quarter-feffions is held for the county. It is built of hewn-ftone, with a piazza. The church being a quarter of a mile diftant from the town, a tower containing a good ring of bells ftands near the market-place. Near the bridge is the county gaol, a modern ftructure. Here are a free grammar-fchool, a chapel near the river, on the fcite of a chantry that was granted for the fupport of the foundation of the fchool, which was part of the old ftructure, and an hofpital for infirm people. In 1215, the townfmen themfelves burnt their town, out of pure hatred to king John, that he might find no fhelter there. Here is a good market on Saturday for corn, cattle, and all neceffary provifions; and there is another on Wednefday, the greateft in England except Smithfield, for live cattle. This is a poft town and a thoroughfare, with many good inns, and plenty of fifh; and here are feveral mills.— The earl of Carlifle's fteward holds a court here twice a-year, one of them the Monday after Michaelmas, when four perfons are chofen by the free burgeffes, who are about 107, and prefented to the fteward, who names two of them to the bailiffs, who, with feven aldermen, are its governors for the year enfuing. Its fairs are on Wednefday, Thurfday, and Friday before Whitfunday, and the Wednefday before July 22. It fends two members to parliament.

MORPHEUS, in fabulous hiftory, the god of fleep, or, according to others, one of the minifters of Somnus. He caufed fleepinefs, and reprefented the forms of dreams. Ovid ftyles him the kindeft of the deities; and he is ufually defcribed in a recumbent pofture, and crowned with poppies.

MORRERI (Lewis), author of the Hiftorical Dictionary, was born at Barge-mont in Provence, 1643. He learned rhetoric and philofophy at Aix, and divinity at Lyons. At 18 years of age he wrote a fmall piece, intitled *Le Pays d'Amour*, and a collection of the fineft French poems intitled *Doux plaifirs de la Poefie.* He learned Spanifh and Italian; and tranflated out of Spanifh into French the book intitled *La Perfection Chretienne de Rodriguez.* He then refined the Saints Lives to the purity of the French tongue. Being ordained prieft, he preached at Lyons, and undertook, when he was but 30 years of age, a new Hiftorical Dictionary, printed at Lyons in one vol. folio, 1673. But his continual labour impaired his health; fo that he died in 1680, aged 37. His fecond volume was publifhed after his death; and four more volumes have fince been added. He left fome other works behind him.

MORRHINA VASA, were a fort of cups or vafes made ufe of by the ancients for drinking out of, and other

other purposes. Authors are not agreed as to the substance of which they were made. Some say it was a stone; some assert that it was a fluid condensed by being buried under ground. All that we know concerning it is, that it was known by the name of *murrha*, and that Heliogabalus's chamber pot was made of it. The word is sometimes written *myrrhina*.

MORRISE-DANCES. See *Moresque-Dances*.

MORS, DEATH, one of the infernal deities, born of Night without a father. She was worshipped by the ancients with great solemnity. She was not represented as an actually existing power, but as an imaginary being. Euripides introduces her in one of his tragedies on the stage. The moderns represent her as a skeleton armed with a scythe and a scymetar.

MORSE, in zoology. See TRICHECUS.

MORTALITY, a term frequently used to signify a contagious disease, which destroys great numbers of either men or beasts.

Bills of MORTALITY, are accounts or registers specifying the numbers born, married, and buried in any parish, town, or district. In general they contain only these numbers; and, even when thus limited, are of great use, by showing the degrees of healthiness and prolificknefs, and the progress of population in the places where they are kept. It is therefore much to be wished, that such accounts had been always correctly kept in every kingdom, and regularly published at the end of every year. We should then have had under our inspection the comparative strength of every kingdom, as far as it depends on the number of inhabitants, and its increase or decrease at different periods. But such accounts are rendered more useful, when they include the ages of the dead, and the distempers of which they have died. In this case they convey some of the most important instructions, by furnishing us with the means of ascertaining the law which governs the waste of human life, the values of annuities dependent on the continuance of any lives, or any survivorships between them, and the favourableness or unfavourableness of different situations to the duration of human life. There are but few registers of this kind; nor has this subject, though so interesting to mankind, ever engaged much attention till lately. The first bills containing the ages of the dead were those for the town of Breslaw in Silesia. It is well known what use has been made of these by Dr Halley, and after him by De Moivre. A table of the probabilities of the duration of human life at every age, deduced from them by Dr Halley, has been published in the Philosophical Transactions, (see the Abridgement, vol. iii. p. 669.) and is the first table of this sort that has been ever published. Since the publication of this table, similar bills have been established in a few towns of this kingdom; and particularly in London, in the year 1728, and at Northampton in 1735.

Two improvements of these registers have been proposed: the first is, that the sexes of all that die in every period of life should be specified in them, under the denomination of *boys*, *married men*, *widowers*, and *bachelors*; and of *girls*, *married women*, *widows*, and *virgins*. The second is, that they should specify the numbers of both sexes dying of every distemper in every month, and at every age. See the end of the 4th essay in Dr Price's Treatise on Reversionary Payments. Registers of mortality thus improved, when compared with records of the seasons, and with the circumstances that discriminate different situations, might contribute greatly to the increase of medical knowledge; and they would afford the necessary data for determining the difference between the duration of human life among males and females; for such a difference there certainly is much in favour of females, as will appear from the following facts.

At Northampton, though more males are born than females, and nearly the same number die; yet the number of living females appeared, by an account taken in 1746, to be greater than the number of males, in the proportion of 2301 to 1770, or 39 to 30.

At Berlin it appeared, from an accurate account which was taken of the inhabitants in 1747, that the number of female citizens exceeded the number of male citizens in the proportion of 459 to 391. And yet out of this smaller number of males, more had died for 20 years preceding 1751, in the proportion of 19 to 17.

At Edinburgh, in 1743, the number of females was to the number of males as 4 to 3. (See Maitland's History of Edinburgh, p. 220.) But the females that died annually from 1749 to 1758, were to the males in no higher proportion than $3\frac{1}{3}$ to 3.

He that will take the pains to examine the accounts in Phil. Transf. abr. vol. vii. part iv. p. 46, &c. will find, that though in the towns there enumerated, the proportion of males and females born is no higher than 19 to 18, yet the proportion of boys and girls that die is 8 to 7; and that, in particular, the still-born and chrysom males are to the still-born and chrysom females as 3 to 2.

In 39 parishes of the district of Vaud in Switzerland, the number of males that died during ten years before 1766 was 8170; of females 8167; of whom the numbers that died under one year of age were 1817 males and 1305 females; and under ten years of age, 3099 males and 2598 females. In the beginning of life, therefore, and before any emigrations can take place, the rate of mortality among males appears to be greater than among females. And this is rendered yet more certain by the following accounts. At Vevey, in the district of Vaud just mentioned, there died in the course of 20 years, ended at 1764, in the first month after birth, of males 135 to 89 females; and in the first year 225 to 162. To the same effect it appears from a table given by Susmilch, in his Gottliche Ordnung, vol. ii. p. 317, that in Berlin 203 males die in the first month, and but 168 females; and in the first year, 489 to 395; and also, from a table of Struycks, that in Holland 396 males die in the first year to 306 females.

The authorities for the facts here mentioned, and much more on this subject, may be found in the 4th essay in Dr Price's Treatise on Reversionary Payments, and in the supplement at the end of that treatise.

We shall here only add the following table, taken from a memoir of Mr Wargentin's, published in the collection of the Memoirs of the Royal Academy of Sciences at Stockholm, printed at Paris in 1772.

In

Mortality.

In all Sweden for nine years, ended in 1763, the proportion of females to males that died out of a given number living, was

Under the age of one year	—	1000 to	1099
From 1 to 3 years of age	—	1000	1022
3 5	—	—	1042
5 10	—	—	1074
10 15	—	—	1080
15 20	—	—	1097
20 25	—	—	1283
25 30	—	—	1161
30 35	—	—	993
35 40	—	—	1159
40 45	—	—	1115
45 50	—	—	1340
50 55	—	—	1339
55 60	—	—	1292
60 65	—	—	1115
65 70	—	—	1080
70 80	—	—	1022
80 90	—	—	1046
Above 90	—	—	1044

Regiſters of mortality on the improved plan before mentioned, were eſtabliſhed in 1772 at Cheſter, and alſo in 1773 at Warrington in Lancaſhire; and they are ſo comprehenſive and correct, that there is reaſon to expect they will afford much inſtruction on the ſubject of human mortality, and the values of lives.

But the country moſt diſtinguiſhed in this reſpect is Sweden: for in that kingdom exact accounts are taken of the births, marriages, and burials, and of the numbers of both ſexes that die at all ages in every town and diſtrict, and alſo at the end of every period of five years, of the numbers living at every age: and at Stockholm a ſociety is eſtabliſhed, whoſe buſineſs it is to ſuperintend and regulate the enumerations, and to collect from the different parts of the kingdom the regiſters, in order to digeſt them into tables of obſervation. Theſe regulations were begun in Sweden in 1755; and tables, containing the reſult of them from 1755 to 1763, have been publiſhed in Mr Wargentin's memoir juſt referred to; and the moſt material parts of them may be found in an eſſay by Dr Price on the Difference between the Duration of Human Life in Towns and in Country Pariſhes, printed in the 65th volume of the Philoſoph. Tranſ. part ii.

In the fourth eſſay in Dr Price's Treatiſe on Reverſionary Payments and Life-Annuities, the following account is given of the principles on which tables of obſervation are formed from regiſters of mortality; and of the proper method of forming them, ſo as to render them juſt repreſentations of the number of inhabitants, and the probabilities of the duration of human life in a town or country.

In every place which juſt ſupports itſelf in the number of its inhabitants, without any recruits from other places; or where, for a courſe of years, there has been no increaſe or decreaſe; the number of perſons dying every year at any particular age, and above it, muſt be equal to the number of the living at that age. The number, for example, dying every year at all ages from the beginning to the utmoſt extremity of life, muſt, in ſuch a ſituation, be juſt equal to the whole number born every year. And for the ſame reaſon, the number dying every year at one year of age and upwards, at two years of age and upwards, at three and upwards, and ſo on, muſt be equal to the numbers that attain to thoſe ages every year; or, which is the ſame, to the numbers of the living at thoſe ages. It is obvious, that unleſs this happens, the number of inhabitants cannot remain the ſame. If the former number is greater than the latter, the inhabitants muſt decreaſe; if leſs, they muſt increaſe. From this obſervation it follows, that in a town or country where there is no increaſe or decreaſe, bills of mortality which give the ages at which all die, will ſhow the exact number of inhabitants, and alſo the exact law according to which human life waſtes in that town or country.

In order to find the number of inhabitants, the mean numbers dying annually at every particular age and upwards muſt be taken as given by the bills, and placed under one another in the order of the ſecond column of the following tables. Theſe numbers will, it has appeared, be the numbers of the living at 1, 2, 3, &c. years of age; and conſequently the ſum diminiſhed by half the number born annually will be the whole number of inhabitants.

This ſubtraction is neceſſary for the following reaſon. In a table formed in the manner here directed, it is ſuppoſed that the numbers in the ſecond column are all living together at the beginning of every year. Thus the number in the ſecond column oppoſite to 0 in the firſt column, the table ſuppoſes to be all juſt born together on the firſt day of the year. The number, likewiſe, oppoſite to 1, it ſuppoſes to attain to one year of age juſt at the ſame time that the former number is born. And the like is true of every number in the ſecond column. During the courſe of the year, as many will die at all ages as were born at the beginning of the year; and conſequently, there will be an exceſs of the number alive at the beginning of the year above the number alive at the end of the year, equal to the whole number of the annual births; and the true number conſtantly alive together, is the arithmetical mean between theſe two numbers; or agreeably to the rule here given, the ſum of the numbers in the ſecond column of the table leſſened by half the number of annual births.

In ſuch a ſeries of numbers, the exceſs of each number above that which immediately follows it will be the number dying every year out of the particular number alive at the beginning of the year; and theſe exceſſes ſet down regularly as in the third column of the table to which we have referred, will ſhow the different rates at which human life waſtes through all its different periods, and the different probabilities of life at all particular ages.

It muſt be remembered, that what has been now ſaid goes on the ſuppoſition, that the place whoſe bills of mortality are given, ſupports itſelf, by procreation only, in the number of its inhabitants. In towns this very ſeldom happens on account of the luxury and debauchery which generally prevail in them. They are, therefore, commonly kept up by a conſtant acceſſion of ſtrangers, who remove to them from country pariſhes and villages. In theſe circumſtances, in order to find the true number of inhabitants, and probabilities

Mortality. babilities of life, from bills of mortality containing an account of the ages at which all die, it is neceffary that the proportion of the annual births to the annual fettlers fhould be known, and alfo the period of life at which the latter remove. Both thefe particulars may be difcovered in the following method.

If for a courfe of years there has been no fenfible increafe or decreafe in a place, the number of annual fettlers will be equal to the excefs of the annual burials above the annual births. If there is an increafe, it will be greater than this excefs. If there is a decreafe, it will be lefs.

The period of life at which thefe fettlers remove, will appear in the bills by an increafe in the number of deaths at that period and beyond it. Thus in the London bills the number of deaths between 20 and 30 is generally above double; and between 30 and 40 near triple the number of deaths between 10 and 20; and the true account of this is, that from the age of 18 or 20 to 35 or 50, there is an afflux of people every year to London from the country, which occafions a great increafe in the number of inhabitants at thefe ages; and confequently raifes the deaths for all ages above 20 confiderably above their due proportion, when compared with the number of deaths before 20. This is obfervable in all the bills of mortality for towns with which we are acquainted, not excepting even the Breflaw bills. Dr Halley takes notice, that thefe bills gave the number of deaths between 10 and 20 too fmall. This he confidered as an irregularity in them owing to chance; and, therefore, in forming his table of obfervations, he took the liberty fo far to correct it, as to render the proportion of thofe who die to the living in this divifion of life nearly the fame with the proportion which, he fays, he had been informed die annually of the young lads in Chrift-Church Hofpital. But the truth is, that this irregularity in the bills was derived from the caufe we have juft affigned. During the five years for which the Breflaw bills are given by Dr Halley, the births did indeed a little exceed the burials; but it appears that this was the effect of fome peculiar caufes that happened to operate juft at that time; for during a complete century from 1633 to 1734, the annual medium of births was 1089, and of burials 1256. This town, therefore, muft have been all along kept up by a number of yearly recruits from other places, equal to about a feventh part of the yearly births.

It appears from the account in the Philofophical Tranfactions (Abridgment, vol. vii. n° 380, p. 46, &c.), that from 1717 to 1725, the annual medium of births at Breflaw was 1252, of burials 1507; and alfo that much the greateft part of the births died under 10 years of age. From a table in Sufmilch's works, vol. i. p. 38. it appears that in reality the greater part of all that die in this town are children under five years of age.

What has been now obferved concerning the period of life at which people remove from the country to fettle in towns, would appear fufficiently probable were there no fuch evidence for it as has been mentioned; for it might be well reckoned that thefe people in general muft be fingle perfons in the beginning of mature life, who, not having yet obtained fettlements in the places where they were born, migrate to towns in queft of employments. Mortality.

Having premifed thefe obfervations, it will be proper next to endeavour to explain diftinctly the effect which thefe acceffions to towns muft have on tables of obfervation formed from their bills of mortality. This is a fubject proper to be infifted on, becaufe miftakes have been committed about it; and becaufe alfo the difcuffion of it is neceffary to fhow how near to truth the values of lives come as deduced from fuch tables.

The following general rule may be given on this fubject. If a place has for a courfe of years been maintained in a ftate nearly ftationary, as to number of inhabitants, by recruits coming in every year, to prevent the decreafe that would arife from the excefs of burials above the births, a table formed on the principle, "that the number dying annually after every particular age, is equal to the number living at that age," will give the number of inhabitants, and the probabilities of life, too great, for all ages preceding that at which the recruits ceafe; and after this it will give them right. If the acceffions are fo great as to caufe an increafe in the place, fuch a table will give the number of inhabitants and the probabilities of life too little after the age at which the acceffions ceafe; and too great if there is a decreafe. Before that age it will in both cafes give them too great; but moft confiderably fo in the former cafe, or when there is an increafe.

Agreeably to thefe obfervations, if a place increafes not in confequence of acceffions from other places, but of a conftant excefs of the births above the deaths, a table conftructed on the principle that has been mentioned will give the probabilities of life too low through the whole extent of life; becaufe in fuch circumftances the number of deaths in the firft ftages of life muft be too great, in comparifon of the number of deaths in the latter ftages; and more or lefs fo as the increafe is more or lefs rapid. The contrary in all refpects takes place where there is a decreafe arifing from the excefs of the deaths above the births.

For example: Let us fuppofe that 244 of thofe born in a town attain annually to 20 years of age, and that 250 more, all likewife 20 years of age, come into it annually from other places, in confequence of which it has for a courfe of years been juft maintained in the number of its inhabitants, without any fenfible increafe or decreafe: in thefe circumftances, the number of the living in the town of the age of 20 will be always 244 natives and 250 fettlers, or 494 in all; and fince thefe are fuppofed all to die in the town, and no more recruits are fuppofed to come in, 494 will be likewife the number dying annually at 20 and upwards. In the fame manner it will appear, on thefe fuppofitions, that the number of the living, at every age fubfequent to 20, will be equal to the number dying annually at that age and above it; and confequently, that the number of inhabitants and the decrements of life, for every fuch age, will be given exactly by the table. But for all ages before 20, they will be given much too great. For let 280 of all born in the town reach 10; in this cafe, 280 will be the true number of the living in the town at the age of 10; and the recruits not coming in till 20, the number given

Mortality given by the bills as dying between 10 and 20 will be the true number dying annually of the living in this division of life. Let this number be 36; and it will follow that the table ought to make the numbers of the living at the ages between 10 and 20, a series of decreasing means between 280 and (280 diminished by 36, or) 244. But in forming the table on the principle just mentioned, 250 (the number above 20 dying annually in the town who were not born in it) will be added to each number in this series; and therefore the table will give the numbers of the living, and the probabilities of life in this division of life, almost twice as great as they really are. This observation, it is manifest, may be applied to all the ages under 20.

It is necessary to add, that such a table will give the number of inhabitants and the probabilities of life equally wrong before 20, whether the recruits all come in at 20, agreeably to the supposition just made, or only begin then to come in. In this last case, the table will give the number of inhabitants and probabilities of life too great throughout the whole extent of life, if the recruits come in at all ages above 20. But if they cease at any particular age, it will give them right only from that age; and before, it will err all along on the side of excess; but less considerably between 20 and that age than before 20. For example: if, of the 250 supposed to come in at 20, only 150 then come in, and the rest at 30; the number of the living will be given 100 too high at every age between 20 and 30; but, as just shown, they will be given 250 too high at every age before 20. In general, therefore, the number of the living at any particular age must be given by the supposed table as many too great as there are annual settlers after that age; and if these settlers come in at all ages indiscriminately, during any certain interval of life, the number of inhabitants and the probabilities of life will be continually growing less and less wrong the nearer any age is to the end of that interval. These observations prove, that tables of observation formed in the common way, from bills of mortality for places where there is an excess of the burials above the births, must be erroneous for a great part of the duration of life, in proportion to the degree of that excess. They show likewise at what parts of life the errors in such tables are most considerable, and how they may be in a great measure corrected.

All this shall be exemplified in the particular case of London.

The number of deaths between the ages of 10 and 20 is always so small in the London bills, that it seems certain few recruits come to London under 20, or at least not so many as before this age are sent out for education to schools and universities. After 20 great numbers come in till 30, and some perhaps till 40 or 50: but at every age after 50, it is probable that more retire from London than come to it. The London tables of observation, therefore, being formed on the principle already mentioned, cannot give the probabilities of life right till 40. Between 30 and 40 they must be a little too high; but more so between 20 and 30, and most of all so before 20. It follows also, that these tables must give the number of inhabitants in London much too great.

The first of the following tables is formed in the Mortality. manner here explained, from the London bills for 10 years, from 1759 to 1768, and adapted to 1000 born as a radix. The sum of the numbers in the second column, diminished by half the number born, is 25,757. According to this table then, for every 1000 deaths in London there are $25\frac{3}{4}$ as many inhabitants; or, in other words, the expectation of a child just born is $25\frac{3}{4}$; and the inhabitants are to the annual burials as $25\frac{3}{4}$ to 1. But it has appeared, that the numbers in the second column, being given on the supposition that all those who die in London were born there, must be too great; and we have from hence a demonstration, that the probabilities of life are given in the common tables of London observations too high for at least the first 30 years of life; and also, that the number of inhabitants in London must be less than $25\frac{3}{4}$ multiplied by the annual burials. The common tables, therefore, of London observations undoubtedly need correction, as Mr Simpson suggested, and in some measure performed; though too imperfectly, and without going upon any fixed principles, or showing particularly how tables of observation ought to be formed, and how far in different circumstances, and at different ages, they are to be depended on. The way of doing this, and in general the right method of forming genuine tables of observation for towns, may be learned from the following rule:

"From the sum of all that die annually, after any given age, subtract the number of annual settlers after that age; and the remainder will be the number of the living at the given time."

This rule can want no explication or proof after what has been already said.

If, therefore, the number of annual settlers in a town at every age could be ascertained, a perfect table of observations might be formed for that town from bills of mortality, containing an account of the ages at which all die in it. But no more can be learned in this instance, from any bills, than the whole number of annual settlers, and the general division of life in which they enter. This, however, may be sufficient to enable us to form tables that shall be tolerably exact. For instance: Suppose the annual deaths in a town which has not increased or decreased, to have been for many years in the proportion of 4 to 3 to the annual births. It will hence follow, that $\frac{1}{4}$ of the persons who die in such a town are settlers, or emigrants from other places, and not natives; and the sudden increase in the deaths after 20 will also show, agreeably to what was before observed, that they enter after this age. In forming, therefore, a table for such a town, a quarter of all that die at all ages throughout the whole extent of life must be deducted from the sum of all that die after every given age before 20; and the remainder will be the true numnumber living at that given age. And if at 20, and every age above it, this deduction is omitted, or the number of the living at every such age is taken the same with the sum of all that die after it, the result will be (supposing most of the settlers to come in before 30, and all before 40) a table exact till 20; too high between 20 and 30; but nearly right for some years before 40; and after 40 exact again. Such a table,

Mortality. table, it is evident, will be the same with the table last described at all ages above 20, and different from it only under 20. It is evident also, that on account of its giving the probabilities of life too great for some years after 20, the number of inhabitants deduced from it may be depended on as somewhat greater than the truth; and more or less so, as the annual recruits enter in general later or sooner after 20.

Let us now consider what the result of these remarks will be, when applied particularly to the London bills.

It must be here first observed, that at least one quarter of all that die in London are supplies or settlers from the country, and not natives. The medium of annual burials for 10 years, from 1759 to 1768, was 22,956; of births 15710. The excess is 7246, or near a third of the burials. The same excess during 10 years before 1750 was 10,500, or near half the burials. London was then decreasing. For the last 12 or 15 years it has been increasing. This excess, therefore, agreeably to the foregoing observations, was then greater than the number of annual settlers, and it is now less. It is however here supposed, that the number of annual settlers is now no more than a quarter of the annual burials, in order to allow for more omissions in the births than the burials; and also, in order to be more sure of obtaining results that shall not exceed the truth.

Of every 1000 then who die in London only 750 are natives, and 250 are recruits who come to it after 18 or 20 years of age; and, consequently, in order to obtain from the bills a more correct table than the first of the following tables, 250 must be subtracted from every one of the numbers in the second column till 20; and the numbers in the third column must be kept the same, the bills always giving these right. After 20, the table is to be continued unaltered; and the result will be, a table which will give the numbers of the living at all ages in London much nearer the truth, but still somewhat too high. Such is the second of the following tables. The sum of all the numbers in the second column of this table, diminished by 500, is 20,750. For every 1000 deaths, therefore, in London, there are, according to this table, 20,750 living persons in it; or for every single death $20\frac{3}{4}$ inhabitants. It was before shown, that the number of inhabitants in London could not be so great as 25 times $\frac{1}{2}$ the deaths. It now appears (since the numbers in the second column of this table are too high) that the number of inhabitants in London cannot be so great as even 20 times $\frac{3}{4}$ the deaths. And this is a conclusion which every one who will bestow due attention on what has been said, will find himself forced to receive. It will not be amiss, however, to confirm it by the following fact, the knowledge of which is derived from the particular enquiry and information of Mr Harris, the late ingenious master of the royal mathematical school in Christ-Church hospital. The average of lads in this school has, for 30 years past, been 831. They are admitted at all ages between 7 and 11; and few stay beyond 16: they are therefore in general, lads between the ages of 8 and 16. They have better accommodations than it can be supposed children commonly have; and about 300 of them have the particular advantage of being educated in the country. In such circumstances, it may be well reckoned, that the proportion of children dying annually must be less than the general proportion of children dying annually at the same ages in London. The fact is, that for the last 30 years $11\frac{4}{5}$ have died annually, or one in $70\frac{2}{5}$. Mortality.

According to Table II one in 73 dies between 10 and 20, and one in 70 between 8 and 16. That table, therefore, probably gives the decrements of life in London, at these ages, too little, and the numbers of the living too great: and if this is true of these ages, it must be true of all other ages under 20; and it follows demonstrably, in conformity to what was before shown, that more people settle in London after 20 than the fourth above supposed; and that from 20 to at least 30 or 35, the numbers of the living are given too great, in proportion to the decrements of life.

In this table the numbers in the second column are doubled at 20, agreeably to what really happens in London; and the sum of the numbers in this column diminished by half the whole number of deaths, gives the expectation of life, not of a child just born, as in other tables, but of all the inhabitants of London at the time they enter it, whether that be at birth or at 20 years of age. The *expectations*, therefore, and the *values* of London lives under 20, cannot be calculated from this table. But it may be very easily fitted for this purpose, by finding the number of births which, according to the given decrements of life, will leave 494 alive at 20; and then adapting the intermediate numbers in such a manner to this radix, as to preserve all along the number of the living in the same proportion to the numbers of the dead. This is done in the third of the following tables; and this table may be recommended as better adapted to the present state of London than any other table. The values of lives, however, deduced from it, are in general nearly the same with those deduced by Mr Simpson from the London bills as they stood forty years ago; the main difference is, that after 52, and in old age, this table gives them somewhat lower than Mr Simpson's table. The fourth and fifth of the following tables, compared with the two last, will give a distinct and full view of the difference between the rate of human mortality in great towns and in country parishes and villages.

TABLE I.

Showing the probabilities of life in London, on the ſuppoſition that all who die in London were born there. Formed from the bills for 10 years, from 1759 to 1768.

Ages.	Perſons living	Decr. of Life.	Ages.	Perſons living	Decr. of Life.	Ages	Perſons living.	Decr. Life.
0	1000	240	31	404	9	62	132	7
1	760	99	32	395	9	63	125	7
2	661	42	33	386	9	64	118	7
3	619	29	34	377	9	65	111	7
4	590	21	35	368	9	66	104	7
5	569	11	36	359	9	67	97	7
6	558	10	37	350	9	68	90	7
7	548	7	38	341	9	69	83	7
8	541	6	39	332	10	70	76	6
9	535	5	40	322	10	71	70	6
10	530	4	41	312	10	72	64	6
11	526	4	42	302	10	73	58	5
12	522	4	43	292	10	74	53	5
13	518	3	44	282	10	75	48	5
14	515	3	45	272	10	76	43	5
15	512	3	46	262	10	77	38	5
16	509	3	47	252	10	78	33	4
17	506	3	48	242	9	79	29	4
18	503	4	49	233	9	80	25	3
19	499	5	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

TABLE II.

Showing the true probabilities of life in London till the age of 19.

Ages.	Perſons living.	Decr of Life.	Ages.	Perſons living.	Decr of Life.
0	750	240	12	272	4
1	510	99	13	268	3
2	411	42	14	265	3
3	369	29	15	262	3
4	340	21	16	259	3
5	319	11	17	256	3
6	308	10	18	253	4
7	298	7	19	249	
8	291	6	20	494	
9	285	5	21	487	
10	280	4	&c.	&c.	
11	276	4			

The numbers in the ſecond column to be continued as in the laſt table.

TABLE III.

Showing the true probabilities of life in London for all ages. Formed from the bills for 10 years, from 1759 to 1768.

Ages.	Perſons living.	Decr. of Life.	Ages.	Perſons living.	Decr. of Life.	Ages	Perſons living.	Decr. Life.
0	1518	486	31	404	9	62	132	7
1	1032	200	32	395	9	63	125	7
2	832	85	33	386	9	64	118	7
3	747	59	34	377	9	65	111	7
4	688	42	35	368	9	66	104	7
5	646	23	36	359	9	67	97	7
6	623	20	37	350	9	68	90	7
7	603	14	38	341	9	69	83	7
8	589	12	39	332	10	70	76	6
9	577	10	40	322	10	71	70	6
10	567	9	41	312	10	72	64	6
11	558	9	42	302	10	73	58	5
12	549	8	43	292	10	74	53	5
13	541	7	44	282	10	75	48	5
14	534	6	45	272	10	76	43	5
15	528	6	46	262	10	77	38	5
16	522	7	47	252	10	78	33	4
17	515	7	48	242	9	79	29	4
18	508	7	49	233	9	80	25	3
19	501	7	50	224	9	81	22	3
20	494	7	51	215	9	82	19	3
21	487	8	52	206	8	83	16	3
22	479	8	53	198	8	84	13	2
23	471	8	54	190	7	85	11	2
24	463	8	55	183	7	86	9	2
25	455	8	56	176	7	87	7	2
26	447	8	57	169	7	88	5	1
27	439	8	58	162	7	89	4	1
28	431	9	59	155	8	90	3	1
29	422	9	60	147	8			
30	413	9	61	139	7			

All the bills, from which the following tables are formed, give the numbers dying under 1 as well as under 2 years; and in the numbers dying under 1 are included, in the country pariſh in Brandenburg and at Berlin, all the ſtill-borns. All the bills alſo give the numbers dying in every period of five years.

TABLE

TABLE IV.

Showing the Probabilities of Life in the Diſtrict of Vaud, Switzerland, formed from the Regiſters of 43 Pariſhes, given by Mr Muret, in the Firſt Part of the Bern Memoirs for the Year 1766.

Age.	Living.	Decr.	Age.	Living	Decr.	Age.	Living.	Decr.
0	1000	189	31	558	5	62	286	12
1	811	46	32	553	5	63	274	12
2	765	30	33	548	4	64	262	12
3	735	20	34	544	5	65	250	14
4	715	14	35	539	6	66	236	16
5	701	13	36	533	6	67	220	18
6	688	11	37	527	7	68	202	18
7	677	10	38	520	7	69	184	16
8	667	8	39	513	7	70	168	15
9	659	6	40	506	6	71	153	13
10	653	5	41	500	6	72	140	11
11	648	5	42	494	6	73	129	10
12	643	4	43	488	6	74	119	10
13	639	4	44	482	6	75	109	11
14	635	4	45	476	7	76	98	13
15	631	5	46	469	8	77	85	14
16	626	4	47	461	10	78	71	13
17	622	4	48	451	10	79	58	12
18	618	4	49	441	10	80	46	10
19	614	4	50	431	9	81	36	7
20	610	4	51	422	8	82	29	5
21	606	4	52	414	8	83	24	4
22	602	5	53	406	9	84	20	3
23	597	5	54	397	9	85	17	3
24	592	5	55	388	11	86	14	3
25	587	5	56	377	13	87	11	2
26	582	5	57	364	16	88	9	2
27	577	5	58	348	17	89	7	2
28	572	5	59	331	17	90	5	1
29	567	4	60	314	15			
30	563	5	61	299	13			

TABLE V.

Showing the Probabilities of Life in a Country Pariſh in Brandenburg, formed from the Bills for 50 Years, from 1710 to 1759, as given by Mr Suſmilch, in his Gottliche Ordnung.

Age.	Living.	Decr.	Age.	Living.	Decr	Age.	Living.	Decr.
0	1000	225	31	482	5	62	260	12
1	775	57	32	477	5	63	248	12
2	718	31	33	472	5	64	236	12
3	687	23	34	467	5	65	224	11
4	664	22	35	462	6	66	213	11
5	642	20	36	456	6	67	202	12
6	622	15	37	450	6	68	190	12
7	607	12	38	444	6	69	178	12
8	595	10	39	438	6	70	166	13
9	585	8	40	432	5	71	153	15
10	577	7	41	427	5	72	138	16
11	570	6	42	422	5	73	122	15
12	564	5	43	417	5	74	107	14
13	559	5	44	412	6	75	93	13
14	554	5	45	407	6	76	80	12
15	549	5	46	400	6	77	68	9
16	544	5	47	394	6	78	59	8
17	539	4	48	388	7	79	51	7
18	535	4	49	381	7	80	44	6
19	531	4	50	374	7	81	38	6
20	527	5	51	367	8	82	32	6
21	522	5	52	359	8	83	25	6
22	517	5	53	351	8	84	21	5
23	212	5	54	343	9	85	15	4
24	507	5	55	334	10	86	11	3
25	502	4	56	324	10	87	8	2
26	498	3	57	314	10	88	6	2
27	495	3	58	304	11	89	4	1
28	492	3	59	293	11	90	3	1
29	489	3	60	282	11	91	2	1
30	486	4	61	271	11	92	1	1

TABLE VI.

Showing the Probabilities of Life at Vienna, formed from the Bills for Eight years, as given by Mr Sufmilch, in his Gottliche Ordnung, page 32, Tables.

Age.	Living.	Decr	Age.	Living	Decr.	Age.	Living.	Decr.
0	1495	682	31	364	6	62	129	6
1	813	107	32	358	5	63	123	7
2	706	61	33	353	6	64	116	7
3	645	46	34	347	7	65	109	8
4	599	33	35	340	8	66	101	8
5	566	30	36	332	8	67	93	8
6	536	20	37	324	8	68	85	7
7	516	11	38	316	9	69	78	7
8	505	9	39	307	9	70	71	6
9	496	7	40	298	8	71	65	5
10	489	6	41	290	7	72	60	5
11	483	5	42	283	6	73	55	4
12	478	5	43	277	6	74	51	4
13	473	6	44	271	7	75	47	5
14	467	6	45	264	8	76	42	5
15	461	6	46	256	9	77	37	5
16	455	7	47	247	9	78	32	5
17	448	6	48	238	9	79	27	4
18	442	6	49	229	9	80	23	3
19	436	6	50	220	8	81	20	2
20	430	5	51	212	7	82	19	2
21	425	5	52	205	7	83	16	2
22	420	5	53	198	7	84	14	2
23	415	6	54	191	7	85	12	2
24	409	6	55	184	8	86	10	2
25	403	6	56	176	8	87	8	2
26	397	6	57	168	9	88	6	2
27	391	7	58	159	8	89	4	1
28	381	7	59	151	8	90	3	1
29	377	7	60	143	7	91	2	1
30	370	6	61	136	7	92	1	1

TABLE VII.

Showing the Probabilities of Life at Berlin, formed from the Bills for Four Years, from 1752 to 1755, given by Mr Sufmilch in his Gottliche Ordnung, vol. ii. page 37, Tables.

Age	Living.	Decr.	Age.	Living.	Decr.	Age.	Living.	Decr.
0	1427	524	33	361	7	65	112	6
1	903	151	34	354	7	66	106	7
2	752	61	35	347	8	67	99	7
3	691	73	36	339	9	68	92	6
4	618	45	37	330	10	69	86	6
5	573	21	38	320	10	70	80	6
6	552	15	39	310	10	71	74	6
7	536	13	40	300	10	72	68	6
8	523	9	41	290	9	73	62	5
9	514	7	42	281	8	74	57	5
10	507	5	43	274	7	75	52	5
11	502	4	44	266	7	76	47	5
12	498	4	45	259	7	77	42	5
13	494	4	46	252	7	78	37	5
14	490	4	47	245	7	79	32	4
15	486	4	48	238	7	80	28	4
16	482	5	49	231	7	81	24	3
17	477	5	50	224	7	82	21	2
18	472	5	51	217	7	83	19	2
19	467	6	52	210	7	84	17	2
20	461	6	53	203	8	85	15	2
21	455	6	54	195	8	86	13	2
22	449	6	55	187	8	87	11	2
23	443	7	56	179	8	88	9	2
24	436	8	57	171	8	89	7	1
25	428	9	58	163	9	90	6	1
26	421	9	59	154	9	91	5	1
27	412	9	60	145	8	92	4	1
28	403	9	61	137	7	93	3	1
29	394	9	62	130	6	94	2	1
30	385	9	63	124	6			
31	376	8	64	118	6			
32	368	7						

Brief *of* MORTANCESTRY, in Scots law; anciently the ground of an action at the inftance of an heir, in the fpecial cafe where he had been excluded from the poffeffion of his anceftor's eftate by the fuperior, or other perfon pretending right.

MORTAR, a preparation of lime and fand mixed with water, which ferves as a cement, and is ufed by mafons and bricklayers in building walls of ftone and brick.

Under the article Cement, we have already given the theory of mortar, as delivered by Mr Anderfon; which has now received a farther confirmation by a recent difcovery, that if the lime is flaked, and the mortar made up, with lime-water inftead of common water, the mortar will be much better. The reafon of this is, that in common water, efpecially fuch as is drawn from wells, there is always a confiderable quantity of fixed air, which, mingling with the mortar previous to its being ufed, fpoils it by reducing the quicklime in part to an inert calcareous earth like chalk; but when it is built up in a perfectly cauftic ftate, it attracts the air fo flowly, that it hardens into a kind of ftony matter as hard as was the rock from whence the limeftone was taken.

Mortar, a chemical utenfil very ufeful for the divifion of bodies, partly by percuffion and partly by grinding. Mortars have the form of an inverted bell. The matter intended to be pounded is to be put into them,

Mortar.

them, and there it is to be ſtruck and bruiſed by a long inſtrument called a *peſtle*. The motion given to the peſtle ought to vary according to the nature of the ſubſtances to be pounded. Thoſe which are eaſily broken, or which are apt to fly out of the mortar, or which are hardened by the ſtroke of the peſtle, require that this inſtrument ſhould be moved circularly, rather by grinding or bruiſing than by ſtriking. Thoſe ſubſtances which are ſoftened by the heat occaſioned by rubbing and percuſſion, require to be pounded very ſlowly. Laſtly, thoſe which are very hard, and which are not capable of being ſoftened, are eaſily pounded by repeated ſtrokes of the peſtle. They require no bruiſing but when they are brought to a certain degree of fineneſs. But theſe things are better learned by habit and practice than by any directions.

As mortars are inſtruments which are conſtantly uſed in chemiſtry, they ought to be kept of all ſizes and materials; as of marble, copper, glaſs, iron, gritſtone, and agate. The nature of the ſubſtance to be pounded determines the choice of the kind of mortar. The hardneſs and diſſolving power of that ſubſtance are particularly to be attended to. As copper is a ſoft metal, ſoluble by almoſt all menſtruums, and hurtful to health, good artiſts have ſome time ago proſcribed the uſe of this metal.

One of the principal inconveniences of pulveriſation in a mortar proceeds from the fine powder which riſes abundantly from ſome ſubſtances during the operation. If theſe ſubſtances be precious, the loſs will be conſiderable; and if they be injurious to health, they may hurt the operator. Theſe inconveniences may be remedied, either by covering the mortar with a ſkin, in the middle of which is a hole, through which the peſtle paſſes; or by moiſtening the matter with a little water when this addition does not injure it; or, laſtly, by covering the mouth and noſe of the operator with a fine cloth, to exclude this powder. Some ſubſtances, as corroſive ſublimate, arſenic, calxes of lead, cantharides, euphorbium, &c. are ſo noxious, that all theſe precautions ought to be uſed, particularly when a large quantity of them is pounded.

Mortar.

Large mortars ought to be fixed upon a block of wood, ſo high, that the mortar ſhall be level with the middle of the operator. When the peſtle is large and heavy, it ought to be ſuſpended by a cord or chain fixed to a moveable pole, placed horizontally above the mortar: this pole conſiderably relieves the operator, becauſe its elaſticity aſſiſts the raiſing of the peſtle.

MORTAR-PIECE, in the military art, a ſhort piece of ordnance, thick and wide, proper for throwing bombs, carcaſes, ſhells, ſtones, bags filled with grapeſhot, &c. See GUNNERY, n° 50.

Land MORTARS, are thoſe uſed in ſieges, and of late in battles, mounted on beds made of ſolid timber, conſiſting generally of four pieces, thoſe of the royal and cohorn excepted, which are but one ſingle block; and both mortar and bed are tranſported on blockcarriages. There is likewiſe a kind of land-mortars, mounted on travelling carriages, invented by count Buckeburg, which may be elevated to any degree; whereas ours are fixed to an angle of 45 degrees, and firmly laſhed with ropes. The following table ſhows the weight of land-mortars and ſhells; together with the quantity of powder the chambers hold when full; the weight of the ſhells, and powder for loading them.

Diameter of mortars.	13-inch.			10-inch.			8-inch.			5.8-inch royal.			4.6-inch cohorn.		
	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.	C.	qr.	lb.
Mortar's weight.	25	0	0	10	2	18	4	0	20	1	1	0	0	3	9
Shell's weight.	1	2	15	0	2	25	0	1	15	0	0	12	0	0	7
	lb.	oz.	gr.	lb.	oz.	gr.	lb.	oz.	gr.	lb.	oz.	gr	lb.	oz.	gr.
Shell's cont. of powder.	9	4	8	4	14	12	2	3	8	1	1	8	0	8	0
Chamber's cont. of powder.	9	1	8	4	0	0	2	0	10	1	0	0	0	8	0

Sea MORTARS, are thoſe which are fixed in the bomb-veſſels for bombarding places by ſea: and as they are generally fired at a much greater diſtance than that which is required by land, they are made ſomewhat longer and much heavier than the land-mortars. The following table exhibits the weight of the ſea-mortars and ſhells, and alſo of their full charges.

Nature of the mortar.	Powder contained in the chamber when full.		Weight of the mortar.			Weight of the ſhell when fixed.	Weight of powder contained in the ſhell.	
	lb.	oz.	C.	qr.	lb.	lb.	lb.	oz.
10-inch howitzer.	12	0	31	2	26			
13-inch mortar.	30	0	81	2	1	198	7	0
10-inch mortar.	12	0	34	2	11	93		

To

Mortar.

To Charge or Load a Mortar, the proper quantity of gunpowder is put into the chamber, and if there be any vacant ſpace they fill it up with hay; ſome chooſe a wooden plug; over this they lay a turf, ſome a wooden tampion fitted to the bore of the piece; and laſtly the bomb; taking care that the fuſe be in the axis thereof, and the orifice be turned from the muzzle of the piece: what ſpace remains is to be filled up with hay, ſtraw, turf, &c. ſo as the load may not be exploded without the utmoſt violence.

The quantity of gunpowder to be uſed is found by dividing the weight of the bomb by 30; though this rule is not always to be ſtrictly obſerved.

When the proper quantity of powder neceſſary to charge a ſea-mortar is put into the chamber, it is covered with a wad well beat down with the rammer. After this the fixed ſhell is placed upon the wad, as near the middle of the mortar as poſſible, with the fuſe-hole uppermoſt, and another wad preſſed down cloſe upon it, ſo as to keep the ſhell firm in its poſition. The officer then points the mortar according to the propoſed inclination.—When the mortar is thus fixed, the fuſe is opened; the priming-iron is alſo thruſt into the touch-hole of the mortar to clear it, after which it is primed with the fineſt powder. This done, two of the matroſſes or ſailors, taking each one of the matches, the firſt lights the fuſe, and the other fires the mortar. The bomb, thrown out by the exploſion of the powder, is carried to the place intended: and the fuſe, which ought to be exhauſted at the inſtant of the ſhell's falling, inflames the powder contained in it, and burſts the ſhell in ſplinters; which, flying off circularly, occaſion incredible miſchief whereſoever they reach.

If the ſervice of mortars ſhould render it neceſſary to uſe pound-ſhots, 200 of them with a wooden bottom are to be put into the 13 inch mortar, and a quantity of powder not exceeding 5 pounds; and 100 of the above ſhot with $2\frac{1}{2}$ pounds of powder, for the 10 inch mortar, or three pounds at moſt.

To Elevate the Mortar ſo as its axis may make any given angle with the horizon, they apply the artillery-level or gunner's quadrant. An elevation of 70 or 80 degrees is what is commonly choſen for rendering mortars moſt ſerviceable in caſting ſhells into towns, forts, &c. though the greateſt range be at 45 degrees.

All the Engliſh mortars are fixed to an angle of 45 degrees, and laſhed ſtrongly with ropes at that elevation. Although in a ſiege there is only one caſe in which ſhells ſhould be thrown with an angle of 45 degrees; that is, when the battery is ſo far off that they cannot otherwiſe reach the works: for when ſhells are thrown out of the trenches into the works of a fortification, or from the town into the trenches, they ſhould have as little elevation as poſſible, in order to roll along, and not bury themſelves; whereby the damage they do, and the terror they occaſion, are much greater than if they ſink into the ground. On the contrary, when ſhells are thrown upon magazines or any other buildings with an intention to deſtroy them, the mortars ſhould be elevated as high as poſſible, that the ſhells may acquire a greater force in their fall, and conſequently do greater execution.

If all mortar pieces were, as they ought to be, exactly ſimilar, and their requiſites of powder as the cubes of the diameters of their ſeveral bores, and if their ſhells, bombs, carcaſes, &c. were alſo ſimilar; then, comparing like with like, their ranges on the plane of the horizon, under the ſame degree of elevation, would be equal; and conſequently one piece being well proved, *i. e.* the range of the grenado, bomb, carcaſe, &c. being found to any degree of elevation, the whole work of the mortar-piece would become very eaſy and exact.

But ſince mortars are not thus ſimilar, it is required, that the range of the piece, at ſome known degree of elevation, be accurately found by meaſuring; and from hence all the other ranges may be determined.

Thus, to find the range of the piece at any other elevation required; ſay, As the ſine of double the angle under which the experiment was made, is to the ſine of double the angle propoſed, ſo is the range known to the range required.

Suppoſe, for inſtance, it be found, that the range of a piece, elevated to 30°, is 2000 yards: to find the range of the ſame piece with the ſame charge when elevated to 45°; take the ſine of 60°, the double of 30°, and make it the firſt term of the rule of three; the ſecond term muſt be the ſine of 90°, the double of 45°, and the third the given range 2000; the fourth term will be 2310, the range of the piece at 45°. If the elevation be greater than 45°, inſtead of doubling it, take the ſine of double its complement to 90°. As ſuppoſe the elevation of a piece be 50°, take the ſine of 80°, the double of 40°. Again, if a determinate diſtance to which a ſhot is to be caſt, be given, and the angle of elevation to produce that effect be required; the range known muſt be the firſt term in the rule of three, which ſuppoſe 2000 yards; the range propoſed, which we ſuppoſe 1600 yards, the ſecond term; and the ſine of 60 double of the elevation for the range of 2000 yards, the third term. The fourth term will be found the ſine of 43° 52′, whoſe half 21° 56′ is the angle of elevation the piece muſt have to produce the deſired effect. And if 21° 56′ be taken from 90°, you will have 68° 4′ for the other elevation of the piece, with which the ſame effect will likewiſe be produced.

Note, to avoid the trouble of finding ſines of double the angles of propoſed elevations, Galileo and Torricelli give us the following table, wherein the ſigns of the angles ſought are had by inſpection.

Degrees

Mortar, Mortgage.

Degrees.	Degrees.	Ranges.	Degrees.	Degrees.	Ranges.
90	0	0	0	0	0
89	1	349	66	24	7431
88	2	698	65	25	7660
87	3	1045	64	26	7880
86	4	1392	63	27	8090
85	5	1736	62	28	8290
84	6	2709	61	29	8480
83	7	2419	60	30	8660
82	8	2556	59	31	8829
81	9	3090	58	32	8988
80	10	3420	57	33	9135
79	11	3746	56	34	9272
78	12	4067	55	35	9397
77	13	4384	54	36	9511
76	14	4695	53	37	9613
75	15	5000	52	38	9703
74	16	5299	51	39	9781
73	17	5592	50	40	9841
72	18	5870	49	41	9903
71	19	6157	48	42	9945
70	20	6428	47	43	9976
69	21	6691	46	44	9994
68	22	6947	45	45	10000
67	23	7193			

The uſe of the table is obvious. Suppoſe, for inſtance, it be known by experiment, that a mortar elevated 15°, charged with three pounds of powder, will throw a bomb to the diſtance of 350 fathoms; and it be required, with the ſame charge, to throw a bomb 100 fathoms farther; ſeek in the table the number anſwering to 15 degrees, and you will find it 5000. Then as 350 is to 450, ſo is 5000 to a fourth number, which is 6428. Find this number, or the neareſt to it, in the table, and againſt it you will find 20° or 70°; the proper angles of elevation.

MORTGAGE, in law, (*mortuum vadium*, or dead-pledge), is where a man borrows of another a ſpecific ſum (*e. g.* 200l.), and grants him an eſtate in fee, on condition that if he, the mortgagor, ſhall pay the mortgagee the ſaid ſum of 200l. on a certain day mentioned in the deed, that then the mortgagor may re-enter on the eſtate ſo granted in pledge; or, as is now the more uſual way, that the mortgagee ſhall re-convey the eſtate to the mortgagor: in this caſe the land which is ſo put in pledge, is by law, in caſe of nonpayment at the time limited, for ever dead and gone from the mortgagor; and the mortgagee's eſtate in the lands is then no longer conditional, but abſolute. But ſo long as it continues conditional, that is, between the time of lending the money and the time allotted for payment, the mortgagee is called *tenant in mortgage.* But as it was formerly a doubt, whether, by taking ſuch eſtate in fee, it did not become liable to the wife's dower, and other incumbrances of the mortgage (though that doubt has been long ago over-ruled by our courts of equity), it therefore became uſual to grant only a long term of years, by way of mortgage; with condition to be void on re-payment of the mortgage-money: which courſe has been ſince continued, principally becauſe on the death of the mortgagee ſuch term becomes veſted in his perſonal repreſentatives, who alone are entitled in equity to receive the money lent, of whatever nature the mortgage may happen to be.

Mortgage.

As ſoon as the eſtate is created, the mortgagee may immediately enter on the lands; but is liable to be diſpoſſeſſed, upon performance of the condition by payment of the mortgage-money at the day limited. And therefore the uſual way is to agree that the mortgagor ſhall hold the land till the day aſſigned for payment; when, in caſe of failure, whereby the eſtate becomes abſolute, the mortgagee may enter upon it and take poſſeſſion, without any poſſibility at law of being afterwards evicted by the mortgagor, to whom the land is now for ever dead. But here again the courts of equity interpoſe; and though a mortgage be thus forfeited, and the eſtate abſolutely veſted in the mortgagee at the common law, yet they will conſider the real value of the tenements compared with the ſum borrowed. And if the eſtate be of greater value than the ſum lent thereon, they will allow the mortgagor at any reaſonable time to re-call or redeem his eſtate; paying to the mortgagee his principal, intereſt, and expences: for otherwiſe, in ſtrictneſs of law, an eſtate worth 1000l. might be forfeited for non-payment of 100l. or a leſs ſum. This reaſonable advantage, allowed to mortgagors, is called the *equity of redemption*; and this enables a mortgagor to call on the mortgagee, who has poſſeſſion of his eſtate, to deliver it back, and account for the rents and profits received on payment of his whole debt and intereſt, thereby turning the *mortuum* into a kind of *vivum vadium*; (ſee VADIUM). But, on the other hand, the mortgagee may either compel the ſale of the eſtate, in order to get the whole of his money immediately; or elſe call upon the mortgagor to redeem his eſtate preſently, or, in default thereof, to be for ever foreclosed from redeeming the ſame; that is, to loſe his equity of redemption without poſſibility of recall. And alſo, in ſome caſes of fraudulent mortgages, the fraudulent mortgagor forfeits all equity of redemption whatſoever. It is not, however, uſual for mortgagees to take poſſeſſion of the mortgaged eſtate, unleſs where the ſecurity is precarious, or ſmall; or where the mortgagor neglects even the payment of intereſt: when the mortgagee is frequently obliged to bring an ejectment, and take the land into his own hands, in the nature of a pledge, or the *pignus* of the Roman law: whereas, while it remains in the hands of the mortgagor, it more reſembles their hypotheca, which was where the poſſeſſion of the thing pledged remained with the debtor. But by ſtatute 7 Geo. II. c. 20. after payment or tender by the mortgagor of principal, intereſt, and coſts, the mortgagee can maintain no ejectment; but may be compelled to re-aſſign his ſecurities. In Glanvil's time, when the univerſal method of conveyance was by livery of ſeiſin or corporal tradition of the lands, no gage or pledge of lands was good unleſs poſſeſſion was alſo delivered to the creditor; *ſi non ſequatur ipſius vadii traditio, curia domini regis hujuſmodi privatas conventiones tueri non ſolet*: for which the reaſon given is, to prevent ſubſequent and fraudulent pledges of the ſame land; *cum in tali caſu poſſit eadem res pluribus aliis creditoribus tum prius tum poſterius invadiari.* And the frauds which have ariſen, ſince the exchange of theſe public and noto-

rious

rious conveyances for more private and secret bargains, have well evinced the wisdom of our ancient law.

MORTIER, an ensign of dignity, borne by the chancellor and grand presidents of the parliament of France. That borne by the chancellor is a piece of cloth of gold, edged and turned up with ermine; and that of the first president is a piece of black velvet edged with a double row of gold-lace, while that of the other presidents is only edged with a single row. This they formerly carried on their heads, as they still do in grand ceremonies, such as the entry of the king; but ordinarily they carry them in the hand.

MORTIFICATION, in medicine and surgery, a total extinction of the natural heat of the body, or a part thereof. Some define mortification a disease, wherein the natural juices of any part quite lose their proper motion; and by that means fall into a fermentative one, and corrupt and destroy the texture of the part. See SURGERY.

MORTIFICATION, in religion, any severe penance observed on a religious account. How ancient and how universal the practice of it has been, and for what reasons observed, see FAST.

MORTIMER (John), a late English artist, born in 1743. According to Mr Strutt, "he was endowed with every requisite to make a great painter; his genius fertile, and his imagination lively. There is an originality in his works which add greatly to their value. No man perhaps touched in the heads and other extremities of his figures with more spirit; and few could draw them more correctly. When he failed, it was from his haste to express his thoughts; so that at times he did not attend with that precision which historical painting requires to the proportion of his figures; and they are sometimes heavy. This defect is, however, well repaid by the lightness of his pencil, and the freedom which appears in his works." He died at his house in Norfolk-street in 1779, aged 36.—"King John granting the Magna Charta to the barons," and the "Battle of Agincourt," two of his capital pictures, have been engraved. The first was nearly finished by Mr Ryland, and completed by Mr Bartolozzi. The last, intended as a companion to the former, was published by Mrs Mortimer.

MORTISE, or MORTOISE, in carpentry, &c. a kind of joint wherein a hole of a certain depth is made in a piece of timber, which is to receive another piece called a *tenon*.

MORTMAIN, or ALIENATION *in Mortmain*, (*in mortua manu*), is an alienation of lands or tenements to any corporation, sole or aggregate, ecclesiastical or temporal*: but these purchases having been chiefly made by religious houses, in consequence whereof the lands became perpetually inherent in one dead hand, this hath occasioned the general appellation of *mortmain* to be applied to such alienations, and the religious houses themselves to be principally considered in forming the statutes of mortmain: in deducing the history of which statutes, it will be matter of curiosity to observe the great address and subtle contrivance of the ecclesiastics in eluding from time to time the laws in being, and the zeal with which successive parliaments have pursued them through all their finesses: how new remedies were still the parents of new evasions; till the legislature at last, though with difficulty, hath obtained a decisive victory.

* See Corporation.

By the common law any man might dispose of his lands to any other private man at his own discretion, especially when the feodal restraints of alienation were worn away. Yet in consequence of these it was always, and is still necessary, for corporations to have a licence of mortmain from the crown, to enable them to purchase lands: for as the king is the ultimate lord of every fee, he ought not, unless by his own consent, to lose his privilege of escheats and other feodal profits, by the vesting of lands in tenants that can never be attainted or die. And such licences of mortmain seem to have been necessary among the Saxons above 60 years before the Norman conquest. But, besides this general licence from the king as lord paramount of the kingdom, it was also requisite, whenever there was a mesne or intermediate lord between the king and the alienor, to obtain his licence also (upon the same feodal principles) for the alienation of the specific land. And if no such licence was obtained, the king or other lord might respectively enter on the lands so alienated in mortmain, as a forfeiture. The necessity of this licence from the crown was acknowledged by the constitutions of Clarendon, in respect of advowsons, which the monks always greatly coveted, as being the groundwork of subsequent appropriations. Yet such were the influence and ingenuity of the clergy, that (notwithstanding this fundamental principle) we find that the largest and most considerable donations of religious houses happened within less than two centuries after the conquest. And (when a licence could not be obtained) their contrivance seems to have been this: That as the forfeiture for such alienations accrued in the first place to the immediate lord of the fee, the tenant who meant to alienate first conveyed his lands to the religious house, and instantly took them back again to hold as tenant to the monastery; which kind of instantaneous seisin was probably held not to occasion any forfeiture: and then, by pretext of some other forfeiture, surrender, or escheat, the society entered into those lands in right of such their newly acquired signiory, as immediate lords of the fee. But when these donations began to grow numerous, it was observed that the feodal services, ordained for the defence of the kingdom, were every day visibly withdrawn; that the circulation of landed property from man to man began to stagnate; and that the lords were curtailed of the fruits of their signiories, their escheats, wardships, reliefs, and the like: and therefore, in order to prevent this, it was ordained by the second of King Henry III.'s great charters, and afterwards by that printed in our common statute-books, that all such attempts should be void, and the land forfeited to the lord of the fee.

Blackst. Comment.

But as this prohibition extended only to religious houses, bishops and other sole corporations were not included therein; and the aggregate ecclesiastical bodies (who, Sir Edward Coke observes, in this were to be commended, that they ever had of their counsel the best learned men that they could get) found many means to creep out of this statute, by buying in lands that were *bona fide* holden of themselves as lords of the fee, and thereby evading the forfeiture; or by taking long leases

Mortmain. leafes for years, which firft introduced thofe extenfive terms, for a thoufand or more years, which are now fo frequent in conveyances. This produced the ftatute *de religiofis*, 7 Edward I.; which provided, that no perfon, religious or other whatfoever, fhould buy, or fell, or receive, under pretence of a gift, or term of years, or any other title whatfoever, nor fhould by any art or ingenuity appropriate to himfelf, any lands or tenements in mortmain; upon pain that the immediate lord of the fee, or, on his default for one year, the lords paramount, and, in default of all of them, the king, might enter thereon as a forfeiture.

This feemed to be a fufficient fecurity againft all alienations in mortmain: but as thefe ftatutes extended only to gifts and conveyances between the parties, the religious houfes now began to fet up a fictitious title to the land, which it was intended they fhould have, and to bring an action to recover it againft the tenant; who, by fraud and collufion, made no defence, and thereby judgment was given for the religious houfe, which then recovered the land by a fentence of law upon a fuppofed prior title. And thus they had the honour of inventing thofe fictitious adjudications of right, which are fince become the great affurance of the kingdom, under the name of *common* RECOVERIES. But upon this the ftatute of Weftminfter the fecond, 13 Edw. I. c. 32. enacted, that in fuch cafes a jury fhall try the true right of the demandants or plaintiffs to the land; and if the religious houfe or corporation be found to have it, they fhall ftill recover feifin; otherwife it fhall be forfeited to the immediate lord of the fee, or elfe to the next lord, and finally to the king, upon the immediate or other lords default. And the like provifion was made by the fucceeding chapter, in cafe the tenants fet up croffes upon their lands (the badges of knights templars and hofpitallers) in order to protect them from the feudal demands of their lords, by virtue of the privileges of thofe religious and military orders. And fo careful was this provident prince to prevent any future evafions, that when the ftatute of *quia emptores*, 18 Edward I. abolifhed all fub-infeudations, and gave liberty for all men to alienate their lands to be holden of their next immediate lord, a provifo was inferted that this fhould not extend to authorife any kind of alienation in mortmain. And when afterwards the method of obtaining the king's licence by writ of *ad quod damnum* was marked out by the ftatute 27 Edward I. ft. 2. it was farther provided by ftatute 34 Edward I. ft. 3. that no fuch licence fhould be effectual without the confent of the mefne or intermediate lords.

Yet ftill it was found difficult to fet bounds to ecclefiaftical ingenuity: for when they were driven out of all their former holds, they devifed a new method of conveyance, by which the lands were granted, not to themfelves directly, but to nominal feoffees to the ufe of the religious houfes; thus diftinguifhing between the poffeffion and the ufe, and receiving the actual profits, while the feifin of the land remained in the nominal feoffee; who was held by the courts of equity (then under the direction of the clergy) to be bound in confcience to account to his *cefluy que ufe* for the rents and emoluments of the eftate. And it is to thefe inventions that our practifers are indebted for the introduction of ufes and trufts, the Mortmain. foundation of modern conveyancing. But, unfortunately for the inventors themfelves, they did not long enjoy the advantage of their new device; for the ftatute 15 Richard II. c. 5. enacts, that the lands which had been fo purchafed to ufes fhould be admortifed by licence from the crown, or elfe be fold to private perfons; and that for the future ufes fhall be fubject to the ftatutes of mortmain, and forfeitable like the lands themfelves. And whereas the ftatutes had been eluded by purchafing large tracts of land adjoining to churches, and confecrating them by the name of *church-yards*, fuch fubtile imagination is alfo declared to be within the compafs of the ftatutes of mortmain. And civil or lay corporations, as well as ecclefiaftical, are alfo declared to be within the mifchief, and of courfe within the remedy provided by thofe falutary laws. And laftly, as during the times of popery lands were frequently given to fuperftitious ufes, though not to any corporate bodies; or were made liable in the hands of heirs and devifees to the charge of obits, chauntries, and the like, which were equally pernicious in a well-governed ftate as actual alienations in mortmain; therefore at the dawn of the Reformation, the ftatute 23 Hen. VIII. c. 10. declares, that all future grants of lands for any of the purpofes aforefaid, if granted for any longer term than 20 years, fhall be void.

But, during all this time, it was in the power of the crown, by granting a licence of mortmain, to remit the forfeiture, fo far as related to its own rights; and to enable any fpiritual or other corporation to purchafe and hold any lands or tenements in perpetuity: which prerogative is declared and confirmed by the ftatute 18 Edw. III. ft. 3. c. 3. But as doubts were conceived at the time of the Revolution how far fuch licence was valid, fince the king had no power to difpenfe with the ftatutes of mortmain by a claufe of *non obftante*, which was the ufual courfe, though it feems to have been unneceffary; and as, by the gradual declenfion of mefne figniories through the long operation of the ftatute of *quia emptores*, the rights of intermediate lords were reduced to a very fmall compafs; it was therefore provided by the ftatute 7 & 8 W. III. c. 37. that the crown for the future at its own difcretion may grant licences to alienate or take in mortmain, of whomfoever the tenements may be holden

After the diffolution of monafteries under H. VIII. though the policy of the next popifh fucceffor affected to grant a fecurity to the poffeffors of abbey-lands, yet, in order to regain fo much of them as either the zeal or timidity of their owners might induce them to part with, the ftatutes of mortmain were fufpended for 20 years by the ftatute 1 & 2 P. & M. c. 8. and during that time any lands or tenements were allowed to be granted to any fpiritual corporation without any licence whatfoever. And long afterwards, for a much better purpofe, the augmentation of poor livings, it was enacted by the ftatute 17 Car. II. c. 3. that appropriators may annex the great tithes to the vicarages; and that all benefices under 100 l. *per annum* may be augmented by the purchafe of lands, without licence of mortmain in either cafe; and the like provifion hath been fince made in favour of the governors of queen Anne's bounty. It hath alfo been held, that the fta-

Morton, Mortuary.

tute 23 Hen. VIII. before-mentioned, did not extend to any thing but ſuperſtitious uſes; and that therefore a man may give lands for the maintenance of a ſchool, an hoſpital, or any other charitable uſes. But as it was apprehended from recent experience, that perſons on their deathbeds might make large and improvident diſpoſitions even for theſe good purpoſes, and defeat the political ends of the ſtatutes of mortmain; it is therefore enacted by the ſtatute 9 Geo. II. c. 36. that no lands or tenements, or money to be laid out thereon, ſhall be given for or charged with any charitable uſes whatſoever, unleſs by deed indented, executed in the preſence of two witneſſes 12 kalendar months before the death of the donor, and enrolled in the court of chancery within ſix months after its execution (except ſtocks in the public funds, which may be transferred within ſix months previous to the donor's death), and unleſs ſuch gift be made to take effect immediately, and be without power of revocation; and that all other gifts ſhall be void. The two univerſities, their colleges, and their ſcholars upon the foundation of the colleges of Eton, Wincheſter, and Weſtminſter, are excepted out of this act: but ſuch exemption was granted with this proviſo, that no college ſhall be at liberty to purchaſe more advowſons than are equal in number to one moiety of the fellows or ſtudents upon the reſpective foundations.

MORTON (Thomas), a learned Engliſh biſhop in the 17th century, was bred at St John's college, Cambridge, and was logic-lecturer of the univerſity. After ſeveral preferments he was advanced to the ſee of Cheſter in 1615, and tranſlated to that of Litchfield and Coventry in 1618; at which time he became acquainted with Antonio de Dominis archbiſhop of Spalatro, whom he endeavoured to diſſuade from returning to Rome. While he was biſhop of Litchfield and Coventry, in which ſee he ſat 14 years, he educated, ordained, and preſented to a living, a youth of excellent parts and memory, who was born blind; and detected the impoſture of the famous boy of Bilſon in Staffordſhire, who pretended to be poſſeſſed with a devil. In 1632 he was tranſlated to the ſee of Durham, in which he ſat with great reputation till the opening of the long parliament, which met in 1640; when he received great inſults from the common people, and was committed twice to cuſtody. The parliament, upon the diſſolution of biſhoprics, voted him 800 l. *per annum*, of which he received but a ſmall part. He died in 1659, in the 95th year of his age and 44th of his epiſcopal conſecration. He publiſhed *Apologia Catholica*, and ſeveral other works; and was a man of extenſive learning, great piety, and temperance.

MORTUARY, in law, is a ſort of eccleſiaſtical heriot *, being a cuſtomary gift claimed by and due to the miniſter in very many pariſhes on the death of his pariſhioners. They ſeem originally to have been only a voluntary bequeſt to the church; being intended, as Lyndewode informs us from a conſtitution of archbiſhop Langham, as a kind of expiation and amends to the clergy for the perſonal tithes, and other eccleſiaſtical duties, which the laity in their life-time might have neglected or forgotten to pay. For this purpoſe, after the lord's heriot or beſt good was taken out, the ſecond beſt chattel was reſerved to the church as a mortuary. And therefore in the laws of king Canute, this mortuary is called *ſoul-ſcot*, or *ſymbolum animæ*. And, in purſuance of the ſame principle, by the laws of Venice, where no perſonal tithes have been paid during the life of the party, they are paid at his death out of his merchandiſe, jewels, and other moveables. So alſo, by a ſimilar policy in France, every man that died without bequeathing a part of his eſtate to the church, which was called *dying without confeſſion*, was formerly deprived of Chriſtian burial; or, if he died inteſtate, the relations of the deceaſed, jointly with the biſhop, named proper arbitrators to determine what he ought to have given to the church, in caſe he had made a will. But the parliament, in 1409, redreſſed this grievance.

* See Heriot.

Mortuary.

It was anciently uſual in England to bring the mortuary to church along with the corpſe when it came to be buried; and thence it is ſometimes called a *corſe-preſent*: a term which beſpeaks it to have been once a voluntary donation. However, in Bracton's time, ſo early as Henry III. we find it rivetted into an eſtabliſhed cuſtom: inſomuch that the bequeſts of heriots and mortuaries were held to be neceſſary ingredients in every teſtament of chattels. *Imprimis autem debet quilibet, qui teſtamentum fecerit, dominum ſuum de meliori re quam habuerit recognoſcere; et poſtea eccleſiam de alia meliori:* the lord muſt have the beſt good left him as an heriot; and the church the ſecond beſt as a mortuary. But yet this cuſtom was different in different places: *in quibuſdam locis habet eccleſia melius animal de conſuetudine; in quibuſdam ſecundum, vel tertium melius; et in quibuſdam nihil: et ideo conſideranda eſt conſuetudo loci.* This cuſtom ſtill varies in different places, not only as to the mortuary to be paid, but the perſon to whom it is payable. In Wales a mortuary or corſe-preſent was due upon the death of every clergyman to the biſhop of the dioceſe; till aboliſhed, upon a recompence given to the biſhop, by the ſtatute 12 Ann. ſt. 2. c. 6. And in the archdeaconry of Cheſter a cuſtom alſo prevailed, that the biſhop, who is alſo archdeacon, ſhould have, at the death of every clergyman dying therein, his beſt horſe or mare, bridle, ſaddle, and ſpurs; his beſt gown or cloak, hat, upper garment under his gown, and tippet, and alſo his beſt ſignet or ring. But by ſtatute 28 Geo. II. c. 6. this mortuary is directed to ceaſe, and the act has ſettled upon the biſhop an equivalent in its room. The king's claim to many goods, on the death of all prelates in England, ſeems to be of the ſame nature; though Sir Edward Coke apprehends, that this is a duty upon death, and not a mortuary: a diſtinction which ſeems to be without a difference. For not only the king's eccleſiaſtical character, as ſupreme ordinary, but alſo the ſpecies of the goods claimed, which bear ſo near a reſemblance to thoſe in the archdeaconary of Cheſter, which was an acknowledged mortuary, puts the matter out of diſpute. The king, according to the record vouched by Sir Edward Coke, is entitled to ſix things; the biſhop's beſt horſe or palfrey, with his furniture; his cloak or gown, and tippet; his cup and cover; his baſon and ewer; his gold ring; and laſtly, his *muta canum*, his mew or kennel of hounds.

This variety of cuſtoms with regard to mortuaries, giving frequently a handle to exactions on the one ſide, and frauds or expenſive litigations on the other, it was thought proper by ſtatute 21 Henry VIII. c. 6. to

to reduce them to ſome kind of certainty. For this purpoſe it is enacted, that all mortuaries, or corſe-preſents to parſons of any pariſh, ſhall be taken in the following manner, unleſs where by cuſtom leſs or none at all is due: *viz.* for every perſon who does not leave goods to the value of ten marks, nothing: for every perſon who leaves goods to the value of ten marks and under 30 pound, 3*s.* 4*d.* if above 30 pounds, and under 40 pounds, 6*s.* 8*d.* if above 40 pounds, of what value ſoever they may be, 10*s.* and no more. And no mortuary ſhall throughout the kingdom be paid for the death of any feme-covert; nor for any child; nor for any one of full age, that is not a houſekeeper; nor for any wayfaring man; but ſuch wayfaring man's mortuary ſhall be paid in the pariſh to which he belongs. And upon this ſtatute ſtands the law of mortuaries to this day.

MORUS, the MULBERRY-TREE: A genus of the tetrandria order, belonging to the monœcia claſs of plants; and in the natural method ranking under the 53d order, *Scabridæ* The male calyx is quadripartite; and there is no corolla: the female calyx is tetraphyllous; there is no corolla; two ſtyles; the calyx like a berry, with one ſeed. There are ſeven ſpecies, viz.

Species. 1. The *nigra*, or common black-fruited mulberry-tree, riſes with an upright, large, rough trunk, dividing into a branchy and very ſpreading head, riſing 20 feet high, or more. It has large, heart-ſhaped, rough leaves; and monœcious flowers, ſucceeded in the females by large ſucculent black berries. There is a variety with jagged leaves and ſmaller fruit.—2. The *alba*, or white mulberry tree, riſes with an upright trunk, branching 20 or 30 feet high; garniſhed with large, oblique, heart-ſhaped, ſmooth, light-green, ſhining leaves, and monœcious flowers ſucceeded by pale-whitiſh fruit. There is a variety with purpliſh fruit. 3. The *papyrifera*, or paper mulberry-tree of Japan, grows 20 or 30 feet high; having large palmated leaves, ſome trilobate, others quinquelobed; and monœcious flowers, ſucceeded by ſmall black fruit.—4. The *rubra*, or red Virginia mulberry-tree, grows 30 feet high; is garniſhed with very large, heart-ſhaped, rough leaves, hairy underneath; and has monœcious flowers, ſucceeded by large reddiſh berries. 5. The *tinctoria*, dyer's mulberry, or fuſtic, has oblong leaves more extended on one ſide at the baſe, with axillary thorns. It is a native of Braſil and Jamaica. 6. The *tatarica*, or Tartarian mulberry, has ovate oblong leaves equal on both ſides and equally ſerrated. It abounds on the banks of the Wolga and the Tanais. 7. The *indica*, or Indian mulberry, has ovate oblong leaves, equal on both ſides, but unequally ſerrated.

The laſt three ſpecies are tender plants in this country; but the four firſt are very hardy, and ſucceed in any common ſoil and ſituation. The leaves are generally late before they come out, the buds ſeldom beginning to open till the middle or towards the latter end of May, according to the temperature of the ſeaſon; and when theſe trees in particular begin to expand their foliage, it is a good ſign of the near approach of fine warm ſettled weather; the white mulberry, however, is generally forwarder in leafing than the black. The flowers and fruit come out ſoon after the leaves; the males in amentums, and the females in ſmall roundiſh heads; neither of which are very conſpicuous, nor poſſeſs any beauty, but for obſervation. The female or fruitful flowers always riſe on the extremity of the young ſhoots, on ſhort ſpurs; and with this ſingularity, that the calyxes of the flowers become the fruit, which is of the berry kind, and compoſed of many tuberances, each of them furniſhing one ſeed. The fruit matures here gradually from about the middle of Auguſt until the middle of September. In dry warm ſeaſons, they ripen in great perfection; but when it proves very wet weather, they ripen but indifferently, and prove devoid of flavour.

Uſes, &c. Conſidered as fruit-trees, the nigra is the only proper ſort to cultivate here; the trees being not only the moſt plentiful bearers, but the fruit is larger and much finer-flavoured than that of the white kind, which is the only other ſort that bears in this country. The three next ſpecies are chiefly employed to form variety in our ornamental plantations; tho' abroad they are adapted to more uſeful purpoſes.

The *fruit* of the black mulberry is exceedingly grateful to the taſte, and is conſidered at the ſame time as laxative and cooling. Like the other acid-ſweet fruits, it allays thirſt (as Dr Cullen obſerves), partly by refrigerating, and partly by exciting an excretion of mucus from the mouth and fauces; a ſimilar effect is alſo produced in the ſtomach, where, by correcting putreſcency, a powerful cauſe of thirſt is removed. A ſyrup is made from the berries gathered before they are ripe, which, taken as a gargle, is excellent for allaying inflammations of the throat, and for cleanſing ulcers in the mouth. The *bark* of the *root*, which has an acrid bitter taſte, poſſeſſes a cathartic power; and has been ſucceſsfully uſed as a vermifuge, particularly in caſes of tænia: the doſe is half a dram of the powder, or a dram of the infuſion. The juice of the black mulberry is alſo employed to give a colour to certain liquors and confections. Some make from it a wine which is not diſagreeable; others employ it for giving a high colour to red wine; which it likewiſe contributes to make ſweet.—Although this juice is of no uſe in dyeing, it gives a red colour to the fingers and to linen, which it is very difficult to remove. Verjuice, ſorrel, lemon, and green mulberries, remove ſpots of this kind from the hands: but with reſpect to linen, the beſt way is to wet the part which has been ſtained, and to dry it with the vapour of ſulphur; the vitriolic acid which eſcapes from this ſubſtance during combuſtion, inſtantly takes off the ſtain.—The *wood* of the mulberry tree is yellow, tolerably hard, and may be applied to various uſes in turnery and carving: But in order to ſeparate the bark, which is rough, thick, thready, and fit for being made into ropes, it is proper to ſteep the wood in water.

Mulberry trees are noted for their *leaves* affording the principal food of that valuable inſect the ſilk-worm. The leaves of the *alba*, or white ſpecies, are preferred for this purpoſe in Europe; but in China, where the beſt ſilk is made, the worms are ſaid to be fed with thoſe of the *morus tatarica*. The advantages of *white mulberry* trees are not confined to the nouriſhment of worms: they may be cut every three or four years like ſallows and poplar trees, to make faggots;

 and

Morus.

and the ſheep eat their leaves in winter, before they are burnt. This kind of food, of which they are extremely fond, is very nouriſhing; it gives a delicacy to the fleſh, and a fineneſs and beauty to the wool. In ſhort, in every climate and in moſt fields, it might be proper, as is the caſe in Spain, to wait for the firſt hoar-froſt ſhaking off the leaves, which are gathered and placed to dry in ſheds or cart-houſes, taking care always to ſtir them from time to time. In Spain, the ſheep are fed on theſe leaves during the cold and froſts. By this method no injury is done to the mulberries, which produce leaves every year; and it is thought that the beauty and fineneſs of the Spaniſh wool is in a great meaſure owing to the uſe of this kind of food. From theſe conſiderations M. Bourgeois infers, that even in countries where, from the nature of the climate, the ſcarcity of workmen and the high price of labour, or any other particular cauſes, ſilk-worms could not be raiſed to any advantage, the cultivation of mulberry trees ought not be neglected.—The fruit of the white mulberry has a ſweetiſh and very inſipid taſte. Birds, however, are very fond of it; and it is remarked that thoſe which have been fed with ſuch fruit are excellent eating.

The *papyrifera*, or paper-mulberry, is ſo called from the paper chiefly uſed by the Japaneſe being made of the bark of its branches; (ſee the article Paper.) The leaves of this ſpecies alſo ſerve for food to the ſilk worm, and is now cultivated with ſucceſs in France. It thrives beſt in ſandy ſoils, grows faſter than the common mulberry, and at the ſame time is not injured by the cold. M. de la Bouviere affirms that he procured a beautiful vegetable ſilk from the bark of the young branches of this ſpecies of mulberry, which he cut while the tree was in ſap, and afterwards beat and ſteeped. The women of Louiſiana procure the ſame kind of production from the ſhoots which iſſue from the ſtock of the mulberry; and which are four or five feet high. After taking off the bark, they dry it in the ſun, and then beat it that the external part may fall off; and the internal part, which is fine bark, remains entire. This is again beaten, to make it ſtill finer; after which they bleach it with dew. It is then ſpun, and various fabrics are made from it, ſuch as nets and fringes: they even ſometimes weave it and make it into cloth.—The fineſt ſort of cloth among the inhabitants of Otaheite and others of the South Sea Iſlands, is made of the bark of this tree, in the manner particularly deſcribed under the article Bark.

The *tinctoria* is a fine timber-tree, and a principal ingredient in moſt of our yellow dyes, for which it is chiefly imported into Europe. The berries are ſweet and wholeſome; but not much uſed, except by the winged tribe, by whoſe care it is chiefly planted.

Culture of the Mulberry. From the nouriſhment which it affords to the ſilk-worm, that valuable inſect to which we are indebted for the materials of our fineſt ſtuffs, the method of cultivating the mulberry tree muſt be peculiarly intereſting wherever its culture can be undertaken with ſucceſs. In France and Italy, vaſt plantations of the trees are made ſolely for their leaves to feed the little animals we have mentioned, which amply reward the poſſeſſors with the ſupply of ſilk which they ſpin from their bowels. Plantations of the mulberry have at different times been recommended in this country for the ſame purpoſe; though nothing has yet been done in that way to any extent, and even the expediency of any ſuch attempt has been doubted by others, upon the ground of its interfering with other branches of rural economics more productive and more congenial to our climate.

Morus.

In the European ſilk-countries, a great many varieties of mulberry trees are diſtinguiſhed, ariſing from difference of climate, ſoil, method of culture, and other accidental cauſes. Among the wild mulberries, we meet with ſome whoſe leaves are roundiſh, and reſembling thoſe of a roſe: hence they have been called the *roſe-leaved* mulberry.

Mulberry trees were firſt cultivated in France in the reign of Charles IX. It has been found by experience that this tree is not ſo peculiar to warm countries, ſuch as Spain, Italy, Provence, Languedoc, and Piedmont; but it may alſo thrive very well in colder countries, ſuch as Touraine, Poitou, Maine, Anjou, Angoumois near Rochefoucault, and even in Germany, where it affords very good nouriſhment for ſilk-worms. They grow in all kinds of ſoil: they thrive beſt in ſtrong and wet lands; but it is alleged that their leaves conſtitute too coarſe food, prejudicial to the worms, and unfavourable to the quality of the ſilk.—A good light land is the beſt kind of ſoil for raiſing them. White mulberry trees have been found to grow in ſandy ſoils where heath would ſcarcely vegetate; but their leaves are too dry, and afford not ſufficient nouriſhment for the ſilk-worms.

Mulberry trees may be propagated either from ſhoots which have taken root, or by ſeed, by layers, and by ſlips. To raiſe black mulberry trees, the ſeed muſt be taken from the largeſt and moſt beautiful mulberries: in raiſing white ones, the ſeed is taken from the fineſt mulberries growing on trees with large whitiſh ſoft and tender leaves, and as little cut as poſſible. The beſt ſeed is commonly got from Piedmont, Languedoc, &c. According to M. Duhamel, that ſeed ſhould be preferred which is gathered in countries where the cold is ſometimes pretty ſevere; becauſe in that caſe the trees are better able to reſiſt the attacks of the froſt. It frequently happens in ſevere winters, as M. Bourgeois obſerves, that the ſtalks of the young mulberry trees, eſpecially during the firſt winter, are deſtroyed by the froſt; but when they are cut cloſe to the earth, they ſend forth as beautiful and vigorous ſtalks as the former. Good ſeed ought to be large, heavy, light coloured, to produce a great deal of oil when it is preſſed, and to crackle when thrown on a red hot ſhovel. This ſeed muſt be ſown in good land.

In the autumn of the ſecond year, all thoſe trees muſt be pulled up which have ſmall leaves of a very deep green, rough, and deeply indented, for they would produce no leaves proper for the ſilk-worms.—In the third year, when the mulberry tree is about the thickneſs of the finger, it muſt be taken up and put in the nurſery. According to M. Bourgeois, mulberries ought to be tranſplanted in the ſpring of the ſecond year, which makes them thrive better, and ſooner attain their growth. Without this tranſplantation, they would put forth only one root like a pivot, and moſt of them would be in danger of periſhing when they are taken up to be put where they are intended.

Morus.

tended to remain. Some cultivators of this tree tell us, that all the young trees, whether large or small, straight or crooked, ought to be cut close to the ground in the third year, that they may put forth a greater number of roots. Others never employ this method but with regard to those which are crooked, or in a languishing state.

White mulberries may be raised for the food of silk-worms, either in the form of a copse, or planted in a regular order, by letting them grow to their natural size. Ingrafting is one of the surest methods of procuring fine leaves from mulberries. Mulberries ingrafted on wild stocks chosen from a good kind, such as those which are produced from the seed of the Italian mulberry, commonly called the *rose-mulberry*, or of the Spanish mulberry, produce, as M. Bourgeois observes, much more beautiful leaves, and of a much better quality for silk-worms, than those which are ingrafted on the common or prickly small-leafed wild-stock. The same observation has been made by a great many cultivators of mulberries, and in particular by M. Thomé of Lyons, whose authority has the greatest weight in whatever regards the cultivation of mulberries and the rearing of silk-worms.

Encyclop. Methodique.

Ingrafted mulberries, it must be confessed, produce a greater number of leaves, and these more nourishing for silk-worms, than wild mulberries. The latter, however, it has been found by experience, may exist for two centuries; whereas the extension of leaves produced by ingrafting, occasions a premature dissipation of the sap of the tree, and thereby accelerates its decay. In a memoir inserted in a treatise on the culture of white mulberries by M. Pomier, it is recommended to ingraft white mulberries upon black ones; and there is reason to think that by following this plan the trees would exist much longer: for it is well known that the white mulberry commonly decays first in the root, whereas the black mulberry is not subject to any malady. In almost all the books on agriculture we find it asserted, that mulberries may be ingrafted on elms. "I will not affirm (says M. Duhamel), that this method of ingrafting has never been succesful; but I have frequently tried it in vain, and I have many reasons for thinking that it cannot be attended with any advantage." In works of the same kind, we are likewise told, "that mulberries may be ingrafted on fig and lime trees; but in general such ingrafting will not succeed, unless there is a great analogy betwixt the trees, and particularly unless the sap is set in motion at the same time."

The greater care we take of mulberries, by dressing them, and lopping off the overgrown branches, they produce the greater plenty of good leaves. It is very prejudicial to the mulberries to strip them when too young of their leaves for the purpose of feeding the worms, because the leaves are the organs of perspiration in trees, and likewise contribute greatly to nutrition by means of their absorbing vessels which imbibe the moisture of the atmosphere. Mulberry trees are so plentifully stored with sap, that they renew their leaves sometimes twice or thrice. When the winter is mild, mulberry trees put forth their leaves very early: but it is always dangerous to accelerate the hatching of the worms in expectation of this event; for no leaves can be depended upon till the beginning of May, those which are prior to this period being in danger of being destroyed by the frosts.

Morus. Mosa.

In Tuscany, especially in the neighbourhood of Florence, M. Nollet tells us, that though the inhabitants do not cultivate half so many mulberries as the Piedmontese, they rear and feed double the quantity, in proportion, of silk-worms. For this purpose they cause the worms hatch only at two different seasons. The first worms which are hatched are fed on the first produce of the mulberry-trees; and when these have produced their silk, other worms are hatched, which are nourished on the second crop of the same trees.

We are told by M. Bourgeois, that several kinds of white mulberries are now cultivated near Bienne in Switzerland. According to this author, the prickly mulberry is the least esteemed of all the white wild mulberries. Its branches are rough with prickles; its leaves are of a small size and few in number; and the reaping of them is difficult and expensive. The common wild mulberry produces indented leaves, oblong, and very slender; but it is worth being attended to, because it thrives very well when planted in a hedge, and in a favourable exposure: it is also earlier in the spring than the other species. The wild mulberry, which is produced from the rose or Italian ingrafted mulberry, bears a great many leaves, of a roundish shape and middling size, inclining to a light yellow, and of an excellent quality.

Of the white ingrafted mulberry-trees, the rose, or Italian ingrafted mulberry, which is now the species most cultivated in France, Italy, and Piedmont, produces great abundance of large thick and smooth leaves. It has now come into great repute, in consequence of the recommendation of M. Thomé, who prefers it to all other species of mulberry-trees for raising silk-worms. It is extremely delicate, however, and suffered greatly in Switzerland from the severe winters of 1766 and 1767. The mulberry called *Roman leaf* is distinguished from every other species by its very large leaves, some of which are frequently found equal in size to those of a gourd. The Spanish mulberry greatly resembles the wild rose-mulberry, except that its leaves are larger and more pointed. It is by no means delicate, and can resist the strongest frosts and the severest winters in cold climates. The leaves of the mulberry called the *small queen* are oblong, moderately large, and exceedingly smooth: This species is of an excellent quality and much esteemed.

MOSA, (anc. geog.) a river of Belgica, rising in mount Vogesus on the borders of the Lingones, and which, after receiving a part of the Rhine called *Vahalis*, forms the island of the Batavi, and passes off into the sea, at no greater distance than 80 miles: its mouth, which is large and broad, is that which Pliny calls *Helius*, denoting *Lower*, according to some German writers. Now called the *Maese*, or *Meuse*; rising in Champaign, on the borders of the county of Burgundy, or the Franche Compté, at a village called *Meuse*, whence the appellation; and running north through Lorrain and Champaign into the Netherlands: it afterwards directs its course north-east, and then west; and joining the Waal, runs to Dort, and

6 falls

Mosæ, Mosaic Law. falls into the German sea, a little below the Briel.—According to Baudrand, it twice receives the Waal; by the first junction forming the island Bommel; and again receives it at Worcum, from which place proceeding to Dort, it divides into two branches, which again uniting together form one large mouth discharging itself into the German sea.

MOSÆ Pons (anc. geog.), supposed to be Maestricht, situated on the Mase. E. Long. 5. 40. N. Lat. 50. 55.

MOSAIC LAW, or the *Law of Moses*, is the most ancient that we know of in the world, and is of three kinds; the moral law, the ceremonial law, and the judicial law. The different manner in which each of these was delivered, may perhaps suggest to us a right idea of their different natures. The moral law, or ten commandments, for instance, was delivered on the top of the mountain, in the face of the whole world, as being of universal influence, and obligatory on all mankind. The ceremonial was received by Moses in private in the tabernacle, as being of peculiar concern, belonging to the Jews only, and destined to cease when the tabernacle was down, and the vail of the temple rent. As to the judicial law, it was neither so publicly nor so audibly given as the moral law, nor yet so privately as the ceremonial; this kind of law being of an indifferent nature, to be observed or not observed, as its rites suit with the place and government under which we live. The five books of Moses called the *Pentateuch*, are frequently styled, by way of emphasis, *the Law*. This was held by the Jews in such veneration, that they would not allow it to be laid upon the bed of any sick person, lest it should be polluted by touching the dead.

Wilson's *Archæol. Dict.*

A TABLE or HARMONY of the MOSAIC LAW, digested into proper Heads, with References to the several Parts of the Pentateuch where the respective Laws occur.

Class I. The Moral Law written on the two Tables, containing the Ten Commandments.	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
The *first table*, which includes				
The first commandment,	20. 23.	—	—	5. 6. 13
The second commandment,	20. 23. 34.	19. 20. 26.	—	4. 5. 6. 7. 8. 10. 11. 12. 13.
The third commandment,	20. 23.	—	—	5.
The fourth commandment,	20. 23. 31. 34. 35.	19. 23. 26.	—	—
The *second table*, including				
The fifth commandment,	20. 22.	19.	—	5.
The sixth commandment,	20.	19.	—	5.
The seventh commandment,	20.	18. 19.	—	5. 23.
The eighth commandment,	20. 23.	19.	—	5.
The ninth commandment,	20. 23.	19.	—	5.
The tenth commandment,	20.	—	—	5.
The sum of both tables,	—	19.	—	6.
Class II. The Ceremonial Law may be fitly reduced to the following heads, *viz.*				
Of the holy place,	20.	17.	—	12.
Of the matter and structure of the tabernacle,	25. 26. 27. 35.	—	—	—
Of the instruments of the same, *viz.*				
The laver of brass,	30.	—	—	—
The altar of burnt offering,	27.	—	—	—
The altar of incense,	30.	—	—	—
The candlestick of pure gold,	25.	—	—	—
The table of shew-bread,	25. 26.	—	—	—
Of the priests and their vestments for glory and beauty,	28.	—	—	—
Of the choosing of the Levites,	—	—	18. 3. 8.	—
Of the priest's office in general,	—	—	3. 18.	—
Of their office in teaching,	—	19. 10.	—	18. 12. 17. 31.
Of their office in blessing,	—	—	6.	—
Of their office in offering; which function largely spreading itself, is divided into these heads, *viz.*				
What the sacrifice ought to be,	—	22.	—	15. 17.
Of the continual fire,	—	6.	—	—
Of the manner of the burnt offerings,	—	6. 7.	—	—
——— the peace offerings,	—	3. 7.	—	—

Of

Mosaic Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of the manner of the sacrifices, according to their several kinds, *viz.*				
For sin committed through ignorance of the law,	—	4.	5.	—
For sin committed through ignorance of the fact,	—	5. 7.	—	—
For sin committed wittingly, yet not through impiety,	—	6.	5.	—
The special law of sacrifices for sin,	—	6. 7.	—	—
Of things belonging to the sacrifices,	—	2. 6. 7.	15.	—
Of the shew-bread,	—	24.	—	—
Of the lamps,	27.	24.	8.	—
Of the sweet incense,	30.	—	—	—
Of the use of ordinary oblations, whereof there were several kinds observed by the priests,				
Of the consecration of the high priests and other priests,	29. 30.	6. 8.	—	—
Of the consecration and office of the Levites,	—	—	8.	—
Of the dwelling of the Levites,	—	—	35.	—
Of the anointing the altar, and all the instruments of the tabernacle,	29. 30.	—	—	—
Of the continual daily sacrifices,	29.	—	28.	—
Of the continual sabbath-day's sacrifice,	—	—	28.	—
Of the solemn sacrifice for feast-days, which were diverse, and had peculiar rites, distinguished into these, *viz.*				
Of trumpets,	—	—	10.	—
Of beginning of months,	—	—	28.	—
Of the three most solemn feasts in general,	23. 34.	23.	—	16.
Of the feast of passover,	12. 13. 25. 34.	23.	9. 28.	16.
Of the feast of pentecost,	23. 24.	23.	28.	16.
Of the feast of tabernacles,	23. 34.	23.	29.	16.
Of the feast of blowing the trumpets,	—	23.	29.	—
Of the feast of expiation,	30.	16. 13.	29.	—
Of the first fruits,	22. 23. 34.	2.	15.	26.
Of tythes,	—	21.	18.	12. 14. 26.
Of fruits growing and not eaten of,	—	19.	—	—
Of the first born,	13. 22. 34.	—	—	15.
Of the sabbatical year,	23.	25.	—	—
Of the year of jubilee,	—	25.	—	—
Of vows in general,	—	27.	30.	13.
What persons ought not to make vows,	—	—	30.	—
What things cannot be vowed,	—	27.	—	23.
Of redemption of vows,	—	27.	—	—
Of the vows of the Nazarites,	—	—	6.	—
Of the laws proper for the priests, *viz.*				
Of pollutions,	—	22.	—	—
Of the high-priest's mourning,	—	21.	—	—
Of his marriage,	—	21.	—	—
Of the mourning of the ordinary priests,	—	21.	—	—
Of their marriage,	—	21.	—	—
Of their being forbid the use of wine, &c.	—	10.	—	—
Of sanctified meats,	— —	6. 17. 19. 20.	5. 18.	12. 15. 18.
Of the office of the Levites, *viz.*				
Teaching,	—	—	—	17. 27. 31.
Offering,	—	—	3. 4. 18.	10.
Other promiscuous ceremonial laws, *viz.*				
Of uncleanness in general,	—	15. 19.	5.	—
Of uncleanness in meats, *viz.*				
Of blood, Gen. ix.	23.	7. 17. 19.	—	12.
Of fat,	—	3. 7.	—	—
Of dead carcases,	22.	17.	—	14.
Other meats, and diverse living creatures,	—	11. 20.	—	14.
Of uncleanness in the issue of seed and blood,	—	15. 12.	—	23.
In the dead bodies of men,	—	—	19.	—
In the leprosy,	—	13. 14.	5.	—

Mosaic Law.

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of circumcision, Gen. xvii.	—	12.	—	—
Of the water of expiation,	—	—	19.	—
Of the mourning of the Israelites,	—	19.	—	14.
Of mixtures,	—	19.	—	14.
Of their garments, and writing the law privately,	—	—	15.	6. 11. 22.
Of young birds not to be taken with the dam,	—	—	—	22.
Of their paddle staves,	—	—	—	23.
CLASS III. The Political Law.				
N. B. The Magistrate is the Keeper of the Precepts of both Tables, and to have respect to human Society;—therefore the Political Laws of the Israelites are referred to both the Tables, and are to be reduced to the several Precepts of the Moral Law.				
Laws referred to the first table namely,				
1st, To the first and second commandments, *viz.*				
Of idolators and apostates,	22.	20.	—	13. 17.
Of abolishing idolatry,	23. 24.	—	33.	7. 12.
Of diviners and false prophets,	22.	19. 20.	—	18.
Of covenants with other gods,	23. 34.	—	—	7.
2d. To the third commandment, *viz.*				
Of blasphemies,	—	24.	15.	—
3d. To the fourth commandment, *viz.*				
Of breaking the sabbath,	31. 35.	—	15.	—
Political laws referred to the second table,				
1st. To the fifth commandment, *viz.*				
Of magistrates and their authority, / Of the power of fathers,	18. 30.	—	11.	1. 13. 17. 23.
2d. To the sixth commandment, *viz.*				
Of capital punishments,	—	—	—	21. 24.
Of wilful murder,	21.	24.	35.	19.
Of manslaughter unwittingly committed, and of the cities of refuge,	21.	—	35.	19. 21. 22.
Of heinous injury,	21.	24.	—	25.
Of punishments not capital,	—	—	—	25.
Of the law of war,	—	—	—	25.
3d. To the seventh commandment, *viz.*				
Of unlawful marriages,	—	18. 20.	—	7. 21.
Of fornication,	—	19.	—	23.
Of whoredom,	22.	21.	—	22.
Of adultery and jealousy,	—	19. 20.	—	—
Of copulation against nature,	22.	18. 20.	—	—
Of divorcements,	—	—	—	24.
Other matrimonial laws,	21.	18. 20.	—	21. 22. 24. 25.
4th. To the eighth commandment, *viz.*				
Of the punishment of thefts,	22.	—	5.	—
Of sacrilege, Joshua vii.	—	—	—	—
Of not injuring strangers,	22. 23.	19.	—	10.
Of not defrauding hirelings,	—	19.	—	26. 25.
Of just weights,	—	19.	—	25.
Of removing the land-mark,	—	—	—	19.
Of lost goods,	22.	—	—	—
Of stray cattle,	22. 23.	—	—	22.
Of corrupted judgments,	23.	19.	—	16. 24.
Of fire breaking out by chance,	22.	—	—	—
Of man-stealing,	—	—	—	24.
Of the fugitive servant,	—	—	—	23.

Of

	Exod. chap.	Levitic. chap.	Numb. chap.	Deut. chap.
Of gathering fruits,	—	19. 23.	—	23. 24.
Of contracts, *viz.*				
Borrowing,	—	—	—	15.
Of the pledge,	22.	—	—	24.
Of uſury,	22.	25.	—	23.
Of ſelling,	21.	25.	—	15.
Of the thing lent,	22.	—	—	—
Of a thing committed to be kept,				
Of heirs,				
5th. To the ninth commandment, viz.				
Of witneſſes,	—	5.	—	17. 19.
The eſtabliſhing the political law,	—	—	—	4.
The eſtabliſhing the divine law in general,	—	—	—	6. 11. 29. 30. 31.
From the dignity of the lawgiver,	—	19. 20. 22.	15.	4. 5. 6. 7. 8. 10. 26. 27.
From the excellency of the laws,	—	—		4. 26.
From the promiſes,	15. 19. 23. 24.	18. 26.	—	4. 5. 6. 7. 10. 11. 12. 28.
From the threatenings,	23.	26.	—	4. 7. 11. 27. 28. 29. 30.

MOSAIC, or Mosaic-work, an aſſemblage of little pieces of glaſs, marble, precious ſtones, &c. of various colours, cut ſquare, and cemented on a ground of ſtucco, in ſuch a manner as to imitate the colours and gradations of painting. The critics are divided as to the origin and reaſon of the name. Some derive it from *moſaicum*, a corruption of *muſaicum*, as that is of *muſivum*, as it was called among the Romans. Scaliger derives it from the Greek μυσα, and imagines the name was given to this ſort of works as being very fine and ingenious. Nebricenſis is of opinion it was ſo called, becauſe *ex illis picturis ornabantur muſea.*

1. Method of performing Moſaic work of *glaſs* is this: They provide little pieces of glaſs, of as many different colours and ſizes as poſſible.

Now, in order to apply theſe ſeveral pieces, and out of them to form a picture, they in the firſt place procure a cartoon or deſign to be drawn; this is transferred to the ground or plaſter by calking, as in painting in freſco. See Fresco.

As this plaſter is to be laid thick on the wall, and therefore will continue freſh and ſoft a conſiderable time, ſo there may be enough prepared at once to ſerve for as much work as will take up three or four days.

This plaſter is compoſed of lime made of hard ſtone, with brick-duſt very fine, gum tragacanth, and whites of eggs: when this plaſter has been thus prepared and laid on the wall, and made the deſign of what is to be repreſented, they take out the little pieces of glaſs with a pair of plyers, and range them one after another, ſtill keeping ſtrictly to the light, ſhadow, different teints, and colours, repreſented in the deſign before; preſſing or flatting them down with a ruler, which ſerves both to ſink them within the ground and to render the ſurface even.

Thus, in a long time, and with a great deal of labour, they finiſh the work, which is ſtill the more beautiful, as the pieces of glaſs are more uniform, and ranged at an even height.

Some of theſe pieces of moſaic-work are performed with that exactneſs, that they appear as ſmooth as a table of marble, and as finiſhed and maſterly as a painting in freſco; with this advantage, that they have a fine luſtre, and will laſt ages.

The fineſt works of this kind that have remained till our time, and thoſe by whom the moderns have retrieved the art, which was in a manner loſt, are thoſe in the church of St Agnes, formerly the temple of Bacchus, at Rome; and ſome at Piſa, Florence, and other cities of Italy. The moſt eſteemed among the works of the moderns are thoſe of Joſeph Pine and the Chevalier Lanfranc, in the church of St Peter at Rome: there are alſo very good ones at Venice.

2. The method of performing Moſaic-work of *marble* is this: The ground of Moſaic works, wholly marble, is uſually a maſſive marble, either white or black. On this ground the deſign is cut with a chiſel, after it has been firſt calked. After it has been cut of a conſiderable depth, *i. e.* an inch or more, the cavities are filled up with marble of a proper colour, firſt faſhioned according to the deſign, and reduced to the thickneſs of the indentures with various inſtruments. To make the piece thus inſerted into the indentures cleave faſt, whoſe ſeveral colours are to imitate thoſe of the deſign, they uſe a ſtucco, compoſed of lime and marble-duſt; or a kind of maſtic, which is prepared by each workman, after a different manner peculiar to himſelf. The figures being marked out, the painter or ſculptor himſelf draws with a pencil the colours of the figures not determined by the ground, and in the ſame manner makes ſtrokes or hatchings in the place where ſhadows are to be: and after he has engraven with the chiſel all the ſtrokes thus drawn, he fills them up with a black maſtic, compoſed partly of Burgundy-pitch poured on hot; taking off afterwards what is ſuperfluous with a piece

Mosaic. piece of soft stone or brick, which, together with water and beaten cement, takes away the mastic, polishes the marble, and renders the whole so even that one would imagine it only consisted of one piece. This is the kind of Mosaic-work that is seen in the pompous church of the invalids at Paris, and the fine chapel at Versailles, with which some entire apartments of that palace are incrustated.

3. As for Mosaic-work of precious stones, other and finer instruments are required than those used in marble; as drills, wheels, &c. used by lapidaries and engravers on stone. As none but the richest marbles and stones enter this work, to make them go the farther, they are sawn into the thinnest leaves imaginable, scarce exceeding half a line in thickness; the block to be sawn is fastened firmly with cords on the bench, and only raised a little on a piece of wood, one or two inches high. Two iron pins, which are on one side the block, and which serve to fasten it, are put into a vice contrived for the purpose; and with a kind of saw or bow, made of fine brass-wire, bent on a piece of spongy wood, together with emery steeped in water, the leaf is gradually fashioned by following the stroke of the design, made on paper, and glued on the piece. When there are pieces enough fastened to form an entire flower, or some other part of the design, they are applied to the ground.

The ground which supports this Mosaic-work is usually of free-stone. The matter with which the stones are joined together is a mastic, or kind of stucco, laid very thin on the leaves as they are fashioned; and this being done, the leaves are applied with plyers.

If any contour, or side of a leaf, be not either squared or rounded sufficiently, so as to fit the place exactly into which it is to be inserted, when it is too large, it is to be brought down with a brass file or rasp; and if it be too little, it is managed with a drill and other instruments used by lapidaries.

Mosaic-work of marble is used in large works, as in pavements of churches, basilics, and palaces; and in the incrustation and vaneering of the walls of the same edifices.

As for that of precious stones, it is only used in small works, as ornaments for altar-pieces, tables for rich cabinets, precious stones being so very dear.

4. Manner of performing Mosaic-work of *gypsum*. Of this stone calcined in a kiln, beaten in a mortar, and sifted, the French workmen make a sort of artificial marbles, imitating precious stones; and of these they compose a kind of Mosaic-work, which does not come far short either of the durableness or the vivacity of the natural stones; and which besides has this advantage, that it admits of continued pieces or paintings of entire compartiments without any visible joining.

Some make the ground of plaster of Paris, others of free-stone. If it be of plaster of Paris, they spread it in a wooden frame, of the length and breadth of the work intended, and in thickness about an inch and a half. This frame is so contrived, that the tenons being only joined to the mortises by single pins, they may be taken asunder, and the frame be dismounted when the plaster is dry. The frame is covered on one side with a strong linen-cloth, nailed all round; which being placed horizontally with the linen at the bottom, is filled with plaster passed through a wide sieve. When the plaster is half dry, the frame is set up perpendicularly, and left till it is quite dry; then it is taken out, by taking the frame to pieces. Mosaic.

In this Mosaic, the ground is the most important part. Now in order to the preparation of this sifted gypsum, which is to be applied on this ground, it is dissolved and boiled in the best English glue, and mixed with the colour that it is to be of; then the whole is worked up together into the usual consistence of plaster, and then is taken and spread on the ground five or six inches thick. If the work be such, as that mouldings are required, they are formed with gouges and other instruments.

It is on this plaster, thus coloured like marble or precious stone, and which is to serve as a ground to a work, either of lapis, agate, alabaster, or the like, that the design to be represented is drawn; having been first pounced or calqued. To hollow or impress the design, they use the same instruments that sculptors do; the ground whereon they are to work not being much less hard than the marble itself. The cavities being thus made in the ground, are filled with the same gypsum boiled in glue, only differently coloured, and thus are the different colours of the original represented. In order that the necessary colours and teints may be ready at hand, the quantities of the gypsum are tempered with the several colours in pots. After the design has been thus filled and rendered visible, by half-polishing it with brick and soft stone, they go over it again, cutting such plates as are either to be weaker or more shadowed, and filling them with gypsum; which work they repeat till all the colours being added one after the other, represent the original to the life. When the work is finished, they scour it with soft stone, sand, and water; after that, with a pumice-stone; and in the last place polish it with a wooden mullet and emery. Lastly, they gave it a lustre, by smearing it over with oil, and rubbing it a long time with the palm of the hand, which gives it a lustre no ways inferior to that of natural marble.

5. In Clavigero's history of Mexico is described a curious kind of Mosaic-work made by the ancient Mexicans of the most delicate and beautiful *feathers* of birds. They raised for this purpose various species of birds of fine plumage with which that country abounds, not only in the palaces of the king, where there were all sorts of animals, but likewise in private houses; and at certain seasons they carried off their feathers to make use of them on this kind of work, or to sell them at market. They set a high value on the feathers of those wonderful little birds which they call *Huitzitzilin*, and the Spaniards *Picaflores*, on account of the smallness, the fineness, and the various colours of them. In these and other beautiful birds, nature supplied them with all the colours which art can produce, and also some which art cannot imitate. At the undertaking of every Mosaic-work several artists assembled: After having agreed upon a design, and taken their measures and proportions, each artist charged himself with the execution of a certain part of the image, and exerted himself so diligently in it with such patience and application, that he frequently spent a whole day in adjusting a feather; first trying one, then another, viewing it sometimes one way, then another,

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Mofaic, Mofambique. another, until he found one which gave his part that ideal perfection propofed to be attained. When the part which each artift undertook was done, they affembled again to form the entire image from them. If any part was accidentally the leaft deranged, it was wrought again until it was perfectly finifhed. They laid hold of the feathers with fmall pincers, that they might not do them the leaft injury, and pafted them on the cloth with *tzauhtli*, or fome other glutinous matter; then they united all the parts upon a little table, or a plate of copper, and flattened them foftly until they left the furface of the image fo equal and fmooth that it appeared to be the work of a pencil.

Thefe were the images fo much celebrated by the Spaniards and other European nations. Whoever beheld them was at a lofs whether he ought to have praifed moft the life and beauty of the natural colours, or the dexterity of the artift and the ingenious difpofition of art. "Thefe images (fays Acofta) are defervedly admired; for it is wonderful how it was poffible, with the feathers of birds, to execute works fo fine and fo equal, that they appear the performance of the pencil; and what neither the pencil nor the colours in painting can effect, they have, when viewed from a fide, an appearance fo beautiful, fo lively, and animated, they give delight to the fight. Some Indians, who are able artifts, copy whatever is painted with a pencil fo perfectly with plumage, that they rival the beft painters of Spain." Thefe works of feathers were even fo highly efteemed by the Mexicans as to be valued more than gold. Cortes, Bernal Diaz, Gomara, Torquemada, and all the other hiftorians who faw them, were at a lofs for expreffions fufficient to praife their perfection. Several works of this kind, our author fays, are ftill preferved in the mufeums of Europe, and many in Mexico; but few, he apprehends, belong to the fixteenth century, and ftill fewer, if any, are of thofe made before the conqueft. The Mofaic-works alfo which the Mexicans made of broken fhells was extremely curious: this art is ftill practifed in Guatimala.

MOSAMBIQUE, a kingdom of Africa, lying fouth of Quiloa, and taking its name from the chief town, which is fituated on an ifland, at the mouth of a river of the fame name, in 15 deg. S. Lat. The ifland is 30 miles in circumference, and very populous, though the air is faid to be very hot, and the foil in general dry, fandy, and barren; yet they have moft of the tropical fruits, with black cattle, hogs, and fheep. There is a kind of fowl here, both the feathers and flefh of which are black, infomuch that, when they are boiled, the broth looks like ink; and yet their flefh is very delicate and good food. The town of Mofambique is regularly fortified, and has a good harbour, defended by a citadel, with feveral churches and monafteries. The Portuguefe fhipping to and from India touch here for refrefhments. As the ifland abounds in cattle, the Portuguefe flaughter and falt up a great deal of beef, which they afterwards fend to the Brazils, or fell to the European fhipping. They alfo barter European goods with the natives for gold, elephants teeth, and flaves. There is another town, called *Mongale*, fituated alfo on an ifland, and garrifoned by the Portuguefe, being their chief magazine for European goods. The gold they receive from the natives is found near the furface of the earth, or in the fands of rivers; no gold mines, or at leaft very few, being at prefent wrought in Africa.

Mofchion, Mofchus. MOSCHION, a name common to four different writers, whofe compofitions, character, and native place, are unknown. Some fragments of their writings remain, fome few verfes, and a treatife *De mulierum affectibus*.

MOSCHUS, a Grecian poet of antiquity, ufually coupled with Bion; and they were both of them cotemporaries with Theocritus. In the time of the latter Grecians, all the ancient Idylliums were collected and attributed to Theocritus; but the claims of Mofchus and Bion have been admitted to fome few little pieces; and this is fufficient to make us inquifitive about their characters and ftory: yet all that can be known about them muft be collected from their own remains. Mofchus, by compofing his delicate elegy on Bion, has given the beft memorials of Bion's life. See BION. Mofchus and Theocritus have by fome critics been fuppofed the fame perfon; but there are irrefragable evidences againft it: others will have him as well as Bion to have lived later than Theocritus, upon the authority of Suidas: while others again fuppofe him to have been the fcholar of Bion, and probably his fucceffor in governing the poetic fchool; which, from the elegy of Mofchus, does not feem unlikely. Their remains are to be found in all the editions of the *Poetæ Minores*.

MOSCHUS, in zoology; a genus of quadrupeds of the order of pecora, having no horns. There are eight fmall cutting teeth in the lower jaw; in the upper, no cutting or fore teeth; but two long tufks, one on each fide, projecting out of the mouth. Plate CCCXV.

1. The mofchiferus, or Thibet mufk, has a bag or tumour on the belly near the navel, and a very fhort tail almoft hid in the fur. The length of the male is about three feet three inches from the nofe to the origin of the tail, and about two feet three inches high at the fhoulder; the female is lefs than the male, has a fharper nofe, has no tufks nor mufk-bag, and is provided with two teats. The head refembles that of the roe: the fur is coarfe like that of the animals of the deer kind; but fofter, very fmooth, erect, plentiful, thick, and long: the colour varies according to the age of the animal and time of the year; but is chiefly blackifh brown on the upper, and hoary, feldom white, on the under parts of the body; the hoofs are long, black, and much divided, and the fpurious hoofs of the fore feet are very long: the fcrotum is of a bright red colour, and the penis very fmall. It inhabits the Afiatic Alps, efpecially the higheft rocky mountains from the Altaic chain to that which divides Thibet from India; likewife in China and Tonquin, and in eaftern Siberia about lake Baikal and the rivers Jenifea and Argun. It avoids mankind, dwelling folitarily in the moft precipitous places of the mountains, among rocks in the fmall narrow valleys furrounded by thefe fnowy hills, and the pine forefts which grow in their interftices. It is a very gentle and timid animal, except in rutting time, when the males fight violently with their tufks for the females; it is exceedingly active in leaping, running, climbing, and fwimming, and is very difficultly tamed; the flefh is eatable, and that of the younger animals is reckoned delicate. The

chace

Moſchus. chace of them is a trade equally difficult and hazardous; if purſued, they ſeek the higheſt tops of the ſnowy peaks, inacceſſible to men or dogs. They take amazing leaps over the tremendous chaſms of their alps, or from rock to rock; treading ſo light on the ſnow with their true and falſe hoofs extended, as ſcarcely to leave a mark; while the dogs which purſue them ſink in, and are forced to deſiſt from the chaſe. They are ſo fond of liberty as never to be kept alive in captivity. They are moſtly taken in ſnares, or ſhot by croſs-bows placed in their tracks, with a ſtring from the trigger for them to tread on, and diſcharge. The Tunguſi ſhoot them with bows and arrows. The ſkins are uſed for bonnets and winter dreſſes. The Ruſſians often ſcrape off the hair, and have a way of preparing them for ſummer cloathing, ſo as to become as ſoft and ſhining as ſilk. The noted drug the muſk is produced from the male. The bag or follicle that contains it is ſituated near the prepuce; and is of a ſomewhat oval figure, flat on one ſide and rounded on the other, having a ſmall open orifice. In young animals this bag is empty; but in adults it is filled with a clotted, oily, friable matter, of a dark brown colour: this is the true muſk, of which each bag contains from a dram and a half to two drams. The beſt comes from Thibet; that which is produced in Siberia having ſomewhat of the flavour of caſtor.

2. The Americanus, or Braſilian muſk, of a reddiſh brown colour, with a black muzzle and white throat, is ſcarcely ſo large as a roe-buck. The fur is ſoft and ſhort; the colour of the head and upper part of the neck is dark brown; the lower part of the neck and throat are white; the body and limbs are reddiſh brown; the hind legs are longer than the fore. This animal, which inhabits Guiana and Braſil, is exceedingly timid, active, and ſwift. Numbers are frequently ſeen ſwimming the rivers, and at that time are eaſily taken. The Indians hunt them, and their fleſh is eſteemed very delicate. The French of Guiana call them *biches* or does, becauſe, notwithſtanding their likeneſs to deer, both ſexes are without horns. Gmelin ſuſpects this animal may only be a fawn of the American roe.

3. The Indicus, or Indian muſk, has ſhort hair of a tawney colour on the upper and whitiſh on the under parts of the body; the tail is ſhort, and the feet have ſpurious hoofs. It inhabits India, and is much of the ſame ſize with the moſchiferus, but the tail is longer and more perceptible; the legs are very ſlender; and the head reſembles that of a horſe, with erect oblong ears.

4. The pigmæus, or pigmy muſk, is marked as to colour like the former, but has no ſpurious hoofs.—The body and head meaſure only nine inches and a half in length; the tail is about an inch long; and the legs are ſmaller than a man's finger. It inhabits the Eaſt Indies and ſeveral of the Indian iſlands. It is called *kant-chel* by the Malayes, and *poet-jang* by the inhabitants of Java. The natives catch them in great numbers, carry them in cages to market, and ſell them for $2\frac{1}{2}$ d. a-piece.

5. The meminna, or Ceylon chevrotin, is in length 17 inches from the noſe to the rump, and of a cinereous olive colour; the throat, breaſt, and belly, are white; the ſides and haunches ſpotted, and barred tranſverſely with white; and the ears are large and open: the tail is very ſhort; and the feet have no ſpurious hoofs. It inhabits Ceylon and Java.

6. The javanicus, or Javan muſk, is of a ferruginous colour on the upper parts of the body, and white all along the under; the tail is long and hairy, white below and at the tip; its legs are ſimilar to thoſe of the pigmy muſk, and furniſhed with very ſmall ſpurious hoofs. This and the meminna ſeem only varieties of the pigmæus.

Moſcow. MOSCOW, the chief province of the empire of Ruſſia, deriving its name from the river Muſcova, or Moſkva, on which the capital is ſituated. It was from this duchy that the czars of old took the title of *dukes of Muſcovy*. The province is bounded on the north by the duchies of Twere, Roſtow, Suſdal, and Wolodimer; on the ſouth by Rezan, from which it is ſeparated by the river Occa; on the eaſt by the principality of Cachine, and the ſame river Occa parting it from Niſi-novogorod; and on the weſt by the duchies of Rzeva, Biela, and Smolenſko. It extends about 200 miles in length, and about 100 in breadth; and is watered by the Moſka, Occa, and Cleſma, which fall into the Wolga: nevertheleſs, the ſoil is not very fertile. The air, however, though ſharp, is ſalubrious; and this conſideration, with the advantage of its being ſituated in the midſt of the beſt provinces in the empire, induced the czars to make it their chief reſidence. In the weſtern part of Moſcow is a large foreſt, from whence flows the celebrated river Nieper, or Boryſthenes, which, traverſing the duchy of Smolenſko, winds in a ſerpentine courſe to Ukraine, Lithuania, and Poland.

Moſcow, the capital of the above province, and till the beginning of the preſent century the metropolis of all Ruſſia, is ſituated in a ſpacious plain on the banks of the river Muſkova. The Ruſſian antiquaries differ conſiderably in their opinions concerning the firſt foundation of Moſcow; the following relation, Mr Coxe ſays, is generally eſteemed by the beſt authors the moſt probable account.

Kiof was the metropolis, when George ſon of Vladimir Monomaka aſcended in 1154 the Ruſſian throne. That monarch, being inſulted in a progreſs through his dominions by a rich and powerful nobleman named Stephen Kutchko, put him to death, and confiſcated his domains, which conſiſted of the lands now occupied by the city of Moſcow and the adjacent territory. Pleaſed with the ſituation of the ground lying at the conflux of the Moſkva and Neglina, he laid the foundation of a new town, which he called Moſkva from the river of that name. Upon the demiſe of George, the new town was not neglected by his ſon Andrew, who transferred the ſeat of empire from Kiof to Vladimir; but it fell into ſuch decay under his immediate ſucceſſors, that when Daniel, ſon of Alexander Nevſki, received, in the diviſion of the empire, the duchy of Muſcovy as his portion, and fixed his reſidence upon the conflux of the Moſkva and Neglina, he may be ſaid to have new founded the town. The ſpot now occupied by the Kremlin was at that time overſpread with a thick wood and a moraſs, in the midſt whereof was a ſmall iſland containing a ſingle wooden hut. Upon this part Daniel conſtructed churches and monaſteries, and various buildings, and encloſed

Moscow. enclosed it with wooden fortifications: he first assumed the title of duke of Moscow; and was so attached to this situation, that when in 1304 he succeeded his brother Andrew Alexandrovich in the great duchy of Vladimir, he did not remove his court to Vladimir, but continued his residence at Moscow, which then became the capital of the Russian dominions. His successors followed his example; among whom his son Ivan considerably enlarged the new metropolis, and in 1367 his grandson Demetrius Ivanovitch Donski surrounded the Kremlin with a brick wall. These new fortifications, however, were not strong enough to prevent Tamerlane in 1382 from taking the town, after a short siege. Being soon evacuated by that desultory conqueror, it again came into the possession of the Russians; but was frequently invaded and occupied by the Tartars, who in the 14th and 15th centuries over-ran the greatest part of Russia, and who even maintained a garrison in Moscow until they were finally expelled by Ivan Vassilievitch I. To him Moscow is indebted for its principal splendor, and under him it became the principal and most considerable city of the Russian empire.

Moscow continued the metropolis of Russia until the beginning of the present century, when, to the great dissatisfaction of the nobility, but with great advantage probably to the state, the seat of empire was transferred to Petersburgh.

Notwithstanding the predilection which Peter conceived for Petersburgh, in which all the succeeding sovereigns excepting Peter II. have fixed their residence, Moscow, according to Mr Coxe, is still the most populous city of the Russian empire. Here the chief nobles who do not belong to the court of the empress reside: they here support a larger number of retainers; they love to gratify their taste for a ruder and more expensive magnificence in the ancient style of feudal grandeur; and are not, as at Petersburgh, eclipsed by the superior splendor of the court.

Moscow is represented as the largest town in Europe; its circumference within the rampart, which encloses the suburbs, being exactly 39 versts or 26 miles; but it is built in so straggling and disjointed a manner, that its population in no degree corresponds to its extent. Some Russian authors state its inhabitants at 500,000 souls, a number evidently exaggerated. According to a late computation, which Mr Coxe says may be depended upon, Moscow contains within the ramparts 250,000 souls, and in the adjacent villages 50,000. The streets of Moscow are in general exceedingly long and broad: some of them are paved; others, particularly those in the suburbs, are formed with trunks of trees, or are boarded with planks like the floor of a room; wretched hovels are blended with large palaces; cottages of one story stand next to the most superb and stately mansions. Many brick structures are covered with wooden tops; some of the wooden houses are painted; others have iron doors and roofs. Numerous churches present themselves in every quarter, built in a peculiar style of architecture; some with domes of copper, others of tin, gilt or painted green, and many roofed with wood. In a word, some parts of this vast city have the look of a sequestered desart, other quarters of a populous town; some of a contemptible village, others of a great capital. Moscow.

Moscow may be considered as a town built upon the Asiatic model, but gradually becoming more and more European, and exhibiting in its present state a motley mixture of discordant architecture. It is distributed into the following divisions. 1. The Kremlin. This stands in the central and highest part of the city; is of a triangular form, and about two miles in circumference; and is surrounded by high walls of stone and brick, which were constructed in the year 1491, under the reign of Ivan Vassilievitch I. It contains the ancient palace of the czars, several churches, two convents, the patriarchal palace, the arsenal now in ruins, and one private house, which belonged to Boris Godunof before he was raised to the throne. 2. Khitaigorod, or the Chinese town, is inclosed on one side by that wall of the Kremlin which runs from the Moskva to the Neglina; and on the other side by a brick wall of inferior height. It is much larger than the Kremlin, and contains the university, the printing-house, and many other public buildings, and all the tradesmens shops. The edifices are mostly stuccoed or white-washed, and it has the only street in Moscow in which the houses stand close to one another without any intervals between them. 3. The Bielgorod, or White Town, which runs quite round the two preceding divisions, is supposed to derive its name from a white wall with which it was formerly enclosed, and of which some remains are still to be seen. 4. Semlainogorod, which environs all the three other quarters, takes its denomination from a circular rampart of earth with which it is encompassed. These two last mentioned divisions exhibit a grotesque groupe of churches, convents, palaces, brick and wooden houses, and mean hovels, in no degree superior to peasants cottages. 5. The Sloboda, or suburbs, form a vast exterior circle round all the parts already described, and are invested with a low rampart and ditch. These suburbs contain, beside buildings of all kinds and denominations, corn-fields, much open pasture, and some small lakes, which give rise to the Neglina. The river *Moskva*, from which the city takes its name, flows through it in a winding channel; but, excepting in spring, is only navigable for rafts. It receives the Yausa in the Semlainogorod, and the Neglina at the western extremity of the Kremlin; the beds of both these last-mentioned rivulets are in summer little better than dry channels.

The places of divine worship at Moscow are exceedingly numerous: including chapels, they amount to above 1000: there are 484 public churches, of which 199 are of brick, and the others of wood; the former are commonly stuccoed or white-washed, the latter painted of a red colour. The most ancient churches of Moscow are generally square buildings, with a cupola and four small domes, some whereof are of copper or iron gilt; others of tin, either plain or painted green. These cupolas and domes are for the most part ornamented with crosses entwined with thin chains or wires. The church of the Holy Trinity, sometimes called the church of Jerusalem, which stands in the Khitaigorod, close to the gate leading into the Kremlin, has a kind of high steeple and nine or ten domes;

Moscow. domes: it was built in the reign of Ivan Vassilievitch II. The inside of the churches is mostly composed of three parts: that called by the Greeks πρόναος, by the Russians trapeza; the body; and the sanctuary or shrine. Over the door of each church is the portrait of the saint to whom it is dedicated, to which the common people pay their homage as they pass along by taking off their hats, crossing themselves, and occasionally touching the ground with their heads. The bells, which form no inconsiderable part of public worship in this country, as the length or shortness of their peals ascertains the greater or lesser sanctity of the day, are hung in belfreys detached from the church: they do not swing like our bells; but are fixed immoveably to the beams, and are rung by a rope tied to the clapper and pulled sideways. Some of these bells are of a stupendous size; one in the tower of St Ivan's church weighs 3551 Russian poods, or 127,836 English pounds. It has always been esteemed a meritorious act of religion to present a church with bells; and the piety of the donor has been measured by their magnitude. According to this mode of estimation, Boris Godunof, who gave a bell of 288,000 pounds to the cathedral of Moscow, was the most pious sovereign of Russia, until he was surpassed by the empress Anne, at whose expence a bell was cast weighing 432,000 pounds, and which exceeded in bigness every bell in the known world. The height of this enormous bell is 19 feet, its circumference at the bottom 21 yards 11 inches; its greatest thickness 23 inches. The beam to which this vast machine was fastened being accidentally burnt, the bell fell down, and a fragment was broken off towards the bottom, which left an aperture large enough to admit two persons a-breast without stooping.

The palace, inhabited by the ancient czars, stands at the extremity of the Kremlin. Part of this palace is old, and remains in the same state in which it was built under Ivan Vassilievitch I. The remainder has been successively added at different intervals without any plan, and in various styles of architecture, which has produced a motley pile of building, remarkable for nothing but the incongruity of the several structures. The top is thickly set, with numerous little gilded spires and globes; and a large portion of the front is decorated with the arms of all the provinces which compose the Russian empire. The apartments are in general exceedingly small, excepting one single room called the council-chamber, in which the ancient czars used to give audience to foreign ambassadors, and which has been repeatedly described by several English travellers who visited Moscow before the Imperial residence was transferred to Petersburgh. The room is large and vaulted, and has in the centre an enormous pillar of stone which supports the cieling. In this palace Peter the Great came into the world, in the year 1672. In that part called the treasury are reposited the crown, jewels, and royal robes, used at the coronation of the sovereign, besides several curiosities relative to the history of the country. Of the great number of churches contained in this city, two in particular, namely, that of St Michael and that of the Assumption of the Virgin Mary, are remarkable; the one for being the place where the sovereigns of Russia were formerly interred, and the other where they are crowned. These edifices, which are situated in the Kremlin, are both in the same style of architecture; and their exterior form, though modelled according to the ancient style of the country, is not absolutely inelegant. In the cathedral of St Michael, which contains the tombs of the Russian sovereigns, the bodies are not, as with us, deposited in vaults, or beneath the pavement, but are entombed in raised sepulchres, mostly of brick, in the shape of a coffin, and about two feet in height. When Mr Coxe visited the cathedral, the most ancient were covered with palls of red cloth, others of red velvet, and that of Peter II. with gold tissue, bordered with silver fringe and ermine. Each tomb has at its lower extremity a small silver plate, upon which is engraved the name of the deceased sovereign, and the æra of his death. Moscow.

The cathedral of the assumption of the Virgin Mary, which has long been appropriated to the coronation of the Russian sovereigns, is the most splendid and magnificent in Moscow. The screen is in many parts covered with plates of solid silver and gold richly worked. From the centre of the roof hangs an enormous chandelier of massy silver, weighing 2940 pounds: it was made in England, and was a present from Morosof, prime minister and favourite of Alexey Michaelovitch. The sacred utensils and episcopal vestments are extraordinarily rich, but the taste of the workmanship is in general rude, and by no means equal to the materials. Many of the paintings which cover the inside walls are of a Colossal size: some are very ancient, and were executed so early as in the latter end of the 15th century. It contains, amongst the rest, a head of the virgin, supposed to have been delineated by St Luke, and greatly celebrated in this country for its sanctity and the power of working miracles. Its face is almost black; its head is ornamented with a glory of precious stones, and its hands and body are gilded, which gives it a most grotesque appearance. It is placed in the skreen, and enclosed within a large silver covering, which is only taken off on great festivals, or for the curiosity of strangers. In this cathedral are deposited the remains of the Russian patriarchs.

The place in the Khitaigorod, where the public archives are deposited, is a strong brick building, containing several vaulted apartments with iron doors. These archives, consisting of a numerous collection of state-papers, were crowded into boxes, and thrown aside like common lumber, until the present empress ordered them to be revised and arranged. In conformity to this mandate, Mr Muller has disposed them in chronological order with such perfect regularity, that any single document may be inspected with little trouble. They are enclosed in separate cabinets with glass doors: those relative to Russia are all classed according to the several provinces which they concern; and over each cabinet is inscribed the name of the province to which it is appropriated. In the same manner the manuscripts relative to foreign kingdoms are placed in separate divisions under the respective titles of Poland, Sweden, England, France, Germany, &c.

The university of Moscow, also situated in the Khitaigorod, was founded, at the instance of Count Shuvalof, by the empress Elizabeth, for 600 students; who are clothed,

Moscow. clothed, boarded, aud instructed, at the expence of the crown. Besides this institution, there are two gymnasia or seminaries for the education of youth, endowed also by Elizabeth; in which are taught, by twenty-three philosophers, divinity, classics, philosophy, the Greek, Latin, Russian, German, French, Italian, and Tartar languages; history, geography, mathematics, architecture, fortification, artillery, algebra, drawing and painting, music, fencing, dancing, reading and writing.

Moscow is the centre of the inland commerce of Russia, and particularly connects the trade between Europe and Siberia. The only navigation to this city is formed by the Moskva, which falling into the Occa near Columna, communicates by means of that river with the Volga. But as the Moskva is only navigable in spring upon the melting of the snows, the principal merchandise is conveyed to and from Moscow upon sledges in winter. As to the retail commerce here, the whole of it is carried on in the Khitaigorod; where, according to a custom common in Russia, as well as in most kingdoms of the East, all the shops are collected together in one spot. The place is like a kind of fair, consisting of many rows of low brick buildings; the interval between them resembling alleys. These shops or booths occupy a considerable space; they do not, as with us, make part of the houses inhabited by the tradesmen, but are quite detached from their dwellings, which for the most part are at some distance in another quarter of the town. The tradesman comes to his shop in the morning, remains there all day, and returns home to his family in the afternoon. Every trade has its separate department; and they who sell the same goods have booths adjoining to each other. Furs and skins form the most considerable article of commerce in Moscow; and the shops which vend those commodities occupy several streets.

Among the curiosities of Moscow, the market for the sale of houses is not the least remarkable. It is held in a large open space in one of the suburbs; and exhibits a great variety of ready-made houses, thickly strewed upon the ground. The purchaser who wants a dwelling, repairs to this spot, mentions the number of rooms he requires, examines the different timbers, which are regularly numbered, and bargains for that which suits him. The house is sometimes paid for on the spot, and taken away by the purchaser; or sometimes the vender contracts to transport and erect it upon the place where it is designed to stand. It may appear incredible to assert, that a dwelling may be thus bought, removed, raised, and inhabited, within the space of a week; but we shall conceive it practicable by considering that these ready-made houses are in general merely collections of trunks of trees tenanted and mortoised at each extremity into one another, so that nothing more is required than the labour of transporting and adjusting them. But this summary mode of building is not always peculiar to the meaner hovels; as wooden structures of very large dimensions and handsome appearance are occasionally formed in Russia with an expedition almost inconceivable to the inhabitants of other countries. A remarkable instance of this dispatch was displayed the last time the empress came to Moscow. Her majesty proposed to reside in the mansion of prince Galitzin, which is esteemed the completest edifice in this city; but as it was not sufficiently spacious for her reception, a temporary addition of wood, larger than the original house, and containing a magnificent suite of apartments, was begun and finished within the space of six weeks. This meteor-like fabric was so handsome and commodious, that the materials which were taken down at her majesty's departure, were to be reconstructed as a kind of imperial villa upon an eminence near the city. Mr Coxe mentions an admirable police in this city for preventing riots, or for stopping the concourse of people in case of fires, which are very frequent and violent in those parts, where the houses are mostly of wood, and the streets are laid with timber. At the entrance of each street there is a chevaux de frize gate, one end whereof turns upon a pivot, and the other rolls upon a wheel; near it is a centry-box in which a man is occasionally stationed. In times of riot or fire the centinal shuts the gate, and all passage is immediately stopped.

Moscow. Among the public institutions of Moscow, the most remarkable is the Foundling Hospital, endowed in 1764 by the present empress, and supported by voluntary contributions and legacies, and other charitable gifts. In order to encourage donations, her majesty grants to all benefactors some valuable privileges, and a certain degree of rank in proportion to the extent of their liberality. Among the principal contributors must be mentioned a private merchant named *Dimidof*, a person of great wealth, who has expended in favour of this charity above L. 100,000. The hospital, which is situated in a very airy part of the town upon a gentle ascent near the river Moskva, is an immense pile of building of a quadrangular shape, part of which was only finished when Mr Coxe (whose account we are transcribing) was at Moscow. It contained, at that time, 3000 foundlings; and, when the whole is completed, will receive 8000. The children are brought to the porter's lodge, and admitted without any recommendation. The rooms are lofty and large; the dormitories, which are separate from the work rooms, are very airy, and the beds are not crowded: each foundling, even each infant, has a separate bed; the bedsteads are of iron; the sheets are changed every week, and the linen three times a-week. Through the whole rooms the greatest neatness prevails; even the nurseries being uncommonly clean, and without any unwholesome smells. No cradles are allowed, and rocking is particularly forbidden. The infants are not swaddled according to the custom of the country, but loosely dressed.—The foundlings are divided into separate classes, according to their respective ages. The children remain two years in the nursery, when they are admitted into the lowest class; the boys and girls continue together until they are seven years of age, at which time they are separated. They all learn to read, write, and cast accounts. The boys are taught to knit; they occasionally card hemp, flax, and wool, and work in the different manufactures. The girls learn to knit, net, and all kinds of needle-work; they spin and weave lace; they are employed in cookery, baking, and house-work of all sorts. At the age of 14 the foundlings enter into the first class; when they have the liberty of choosing any

Moselle, Moses.

any particular branch of trade; and for this purpose there are different species of manufactures established in the hospital, of which the principal are embroidery, silk stockings, ribbands, lace, gloves, buttons, and cabinet work. A separate room is appropriated to each trade. Some boys and girls are instructed in the French and German languages, and a few boys in the Latin tongue; others learn music, drawing, and dancing. About the age of 20, the foundlings receive a sum of money, and several other advantages, which enable them to follow their trade in any part of the empire; a very considerable privilege in Russia, where the peasants are slaves, and cannot leave their village without the permission of their master.—The girls and boys eat separately. The dining rooms, which are upon the ground-floor, are large and vaulted, and distinct from their work-rooms. The first class sit at table; the rest stand: the little children are attended by servants; but those of the first or second class alternately wait upon each other. Their victuals are of the most wholesome and nourishing kinds. Each foundling has a napkin, pewter plate, a knife, fork, and spoon: the napkin and table-cloth are clean three times in the week. They rise at six, dine at eleven, and sup at six. The little children have bread at seven and at four. When they are not employed in their necessary occupations, the utmost freedom is allowed, and they are encouraged to be as much in the air as possible.

MOSELLE, a river of Germany, which rises in the mountains of Vauge in Lorrain, and, running thro' that duchy and the electorate of Triers, falls into the Rhine at Coblentz.

MOSES, the son of Amram and Jochebed, was born in the year 1571 before Christ. Pharaoh king of Egypt, perceiving that the Hebrews were become a formidable nation, issued forth an edict commanding all the male children to be put to death. Jochebed the mother of Moses, having, to avoid this cruel edict, concealed her son for three months, at length made an ark or basket of bulrushes, daubed it with pitch, laid the child in it, and exposed him on the banks of the Nile. Thermuthis the king's daughter, who happened to be walking by the river's side, perceived the floating cradle, commanded it to be brought to her, and, struck with the beauty of the child, determined to preserve his life. In three years afterwards the princess adopted him for her own son, called his name *Moses*, and caused him be diligently instructed in all the learning of the Egyptians. But his father and mother, to whom he was restored by a fortunate accident, were at still greater pains to teach him the history and religion of his fathers. Many things are related by historians concerning the first period of Moses's life, which are not to be found in the Old Testament. According to Josephus and Eusebius, he made war on the Ethiopians, and completely defeated them. They add, that the city Saba, in which the enemy had been forced to take refuge, was betrayed into his hands by the king's daughter, who became deeply enamoured of him, when she beheld from the top of the walls his valorous exploits at the head of the Egyptian army. But as the truth of this expedition is more than doubtful, we shall therefore confine ourselves to the narrative of sacred writ, which commences at the fortieth year of Moses's life. He then left the court of Pharaoh, and went to visit his countrymen the Hebrews, who groaned under the ill-usage and oppression of their unfeeling masters. Having perceived an Egyptian smiting an Hebrew, he slew the Egyptian, and buried him in the sand. But he was obliged, in consequence of this murder, to fly into the land of Midian, where he married Zipporah, daughter of the priest Jethro, by whom he had two sons, Gershom and Eliezar. Here he lived 40 years; during which time his employment was to tend the flocks of his father-in-law. Having one day led his flock towards Mount Horeb, God appeared to him in the midst of a bush which burned with fire but was not consumed, and commanded him to go and deliver his brethren from their bondage. Moses at first refused to go; but was at length prevailed on by two miracles which the Almighty wrought for his conviction. Upon his return to Egypt, he, together with his brother Aaron, went to the court of Pharaoh, and told him that God commanded him to let the Hebrews go to offer sacrifices in the desert of Arabia. But the impious monarch disregarded this command, and caused the labour of the Israelites to be doubled. The messengers of the Almighty again returned to the king, and wrought a miracle in his sight, that they might move his heart, and induce him to let the people depart. Aaron having cast down his miraculous rod, it was immediately converted into a serpent: but the same thing being performed by the magicians, the king's heart was hardened more and more; and his obstinacy at last drew down the judgments of the Almighty on his kingdom, which was afflicted with ten dreadful plagues. The first was the changing of the waters of the Nile and of all the rivers into blood, so that the Egyptians died of thirst. In consequence of the second plague, the land was covered with innumerable swarms of frogs, which entered even into Pharaoh's palace. By the third plague, the dust was converted into lice, which cruelly tormented both man and beast. The fourth plague was a multitude of destructive flies which spread throughout Egypt, and infested the whole country. The fifth was a sudden pestilence, which destroyed all the cattle of the Egyptians, without injuring those of the Israelites. The sixth produced numberless ulcers and fiery biles upon man and upon beast. The seventh was a dreadful storm of hail, accompanied with thunder and lightning, which destroyed every thing that was in the field, whether man or beast, and spared only the land of Goshen, where the children of Israel dwelt. By the eighth plague swarms of locusts were brought into the country, which devoured every green herb, the fruit of the trees and the produce of the harvest. By the ninth plague thick darkness covered all the land of Egypt, except the dwellings of the children of Israel. The tenth and last plague was the death of the first-born in Egypt, who were all in one night cut off by the destroying angel, from the first-born of the king to the first-born of the slaves and of the cattle. This dreadful calamity moved the heart of the hardened Pharaoh, and he at length consented to allow the people of Israel to depart from his kingdom.

Profane authors who have spoken of Moses, seem to have been in part acquainted with these mighty wonders.

wonders. That he performed miracles, muft have been allowed by many, by whom he was confidered as a famous magician; and he could fcarcely appear in any other light to men who did not acknowledge him for the meffenger of the Almighty. Both Diodorus and Herodotus mention the diftreffed ftate to which Egypt was reduced by thefe terrible calamities. The Hebrews, amounting to the number of 600,000 men, without reckoning women and children, left Egypt on the 15th day of the month Nifan, which, in memory of this deliverance, was thenceforth reckoned the firft month of their year. Scarcely had they reached the fhore of the Red Sea when Pharaoh with a powerful army fet out in purfuit of them. On this occafion Mofes ftretched forth his rod upon the fea; and the waters thereof being divided, remained fufpended on both fides till the Hebrews paffed through dry-footed.—The Egyptians determined to follow the fame courfe; but God caufed a violent wind to blow, which brought back the waters to their bed, and the whole army of Pharaoh perifhed in the waves.

After the miraculous paffage of the Red Sea, the army proceeded towards Mount Sinai, and arrived at Marah, where the waters were bitter; but Mofes, by cafting a tree into them, rendered them fit for drinking. Their tenth encampment was at Rephidim; where Mofes drew water from the rock in Horeb, by fmiting it with his rod. Here likewife Amalek attacked Ifrael. While Jofhua fought againft the Amalekites, Mofes ftood on the top of a hill, and lifted up his hands; in confequence of which the Ifraelites prevailed, and cut their enemies in pieces. They at length arrived at the foot of Mount Sinai on the third day of the ninth month after their departure from Egypt. Mofes having afcended feveral times into the Mount, received the law from the hand of God himfelf in the midft of thunders and lightnings, and concluded the famous covenant betwixt the Lord and the children of Ifrael. When he defcended from Sinai, he found that the people had fallen into the idolatrous worfhip of the golden calf. The meffenger of God, fhocked at fuch ingratitude, broke in pieces the tables of the law which he carried in his hands, and put 23,000 of the tranfgreffors to the fword. He afterwards reafcended into the mountain, and there obtained new tables of ftone on which the law was infcribed. When Mofes defcended, his face fhone fo that the Ifraelites dared not to come nigh unto him, and he was obliged to cover it with a veil. The Ifraelites were here employed in conftructing the tabernacle according to a pattern fhown them by God. It was erected and confecrated at the foot of the Mount Sinai on the firft day of the firft month of the fecond year after their departure from Egypt; and it ferved the Ifraelites inftead of a temple till the time of Solomon, who built a houfe for the God of his fathers after a model fhown him by David.

Mofes having dedicated the tabernacle, he confecrated Aaron and his fons to be its minifters, and appointed the Levites to its fervice. He likewife gave various commandments concerning the worfhip of God and the political government of the Jews. This was a *theocracy* in the full extent of the word. God himfelf governed them immediately by means of his fervant Mofes, whom he had chofen to be the interpreter of his will to the people; and he required all the honours belonging to their king to be paid unto himfelf. He dwelt in his tabernacle, which was fituated in the middle of the camp, like a monarch in his palace. He gave anfwers to thofe who confulted him, and himfelf denounced punifhments againft the tranfgreffors of his laws. This properly was the time of the theocracy, taken in its full extent; for God was not only confidered as the divinity who was the object of their religious worfhip, but as the fovereign to whom the honours of fupreme majefty were paid. The cafe was nearly the fame under Jofhua; who, being filled with the fpirit of Mofes, undertook nothing without confulting God. Every meafure, both of the leader and of the people, was regulated by the direction of the Almighty, who rewarded their fidelity and obedience by a feries of miracles, victories, and fucceffes. After Mofes had regulated every thing regarding the civil adminiftration, and the marching of the troops, he led the Ifraelites to the confines of Canaan, to the foot of Mount Nebo. Here the Lord commanded him to afcend into the mountain; whence he fhowed him the promifed land, whereinto he was not permitted to enter. He immediately after yielded up the ghoft, without ficknefs or pain, in the 120th year of his age, and 1451 years before Jefus Chrift.

Mofes is inconteftably the author of the firft five books of the Old Teftament, which go by the name of the *Pentateuch;* and which are acknowleged to be infpired, by the Jews and by Chriftians of every perfuafion. Some, however, have denied that Mofes was the author of thefe books; and have founded their opinion on this, that he always fpeaks of himfelf in the third perfon. But this manner of writing is by no means peculiar to Mofes: it occurs alfo in feveral ancient hiftorians; fuch as Xenophon, Cæfar, Jofephus, &c. who, poffeffed of more modefty or good fenfe than fome modern hiftorians, whofe egotifm is altogether difgufting, have not like them left to pofterity a fpectacle of ridiculous vanity and felf-conceit. After all, it is proper to obferve, that profane authors have related many falfehoods and abfurdities concerning Mofes, and concerning the origin and the religion of the Jews, with which they were but little acquainted. Plutarch, in his book concerning Ifis and Ofiris, fays, that Judæus and Hierofolymus were brothers, and defcended from Typhon; and that the former gave his name to the country and its inhabitants, and the latter to the capital city. Others fay that they came from Mount Ida in Phrygia. Strabo is the only author who fpeaks any thing like reafon and truth concerning them; tho' he too fays that they were defcended from the Egyptians, and confiders Mofes their legiflator as an Egyptian prieft. He acknowledges, however, that they were a people ftrictly juft and fincerely religious. Other authors by whom they are mentioned, feem not to have had the fmalleft acquaintance either with their laws or their worfhip. They frequently confound them with the Chriftians, as is the cafe with Juvenal, Tacitus, and Quintilian.

MOSHEIM (John Laurence), an illuftrious German divine, was born in 1695, of a noble family, which might feem to open to his ambition a fair path to civil promotion; but his zeal for the interefts of religion,

religion, his thirſt after knowledge, and particularly his taſte for ſacred literature, induced him to conſecrate his talents to the ſervice of the church. The German univerſities loaded him with literary honours; the king of Denmark invited him to ſettle at Copenhagen; the duke of Brunſwick called him thence to Helmſtadt, where he filled the academical chair of divinity; was honoured with the character of eccleſiaſtical counſellor to the court; and preſided over the ſeminaries of learning in the duchy of Wolfenbuttle and the principality of Blackenburgh. When a deſign was formed of giving an uncommon degree of luſtre to the univerſity of Gottingen, by filling it with men of the firſt rank in letters, Dr Moſheim was deemed worthy to appear at the head of it, in quality of chancellor; and here he died, univerſally lamented, in 1755. In depth of judgment, in extent of learning, in purity of taſte, in the powers of eloquence, and in a laborious application to all the various branches of erudition and philoſophy, he had certainly very few ſuperiors. His Latin tranſlation of Cudworth's Intellectual Syſtem, enriched with large annotations, diſcovered a profound acquaintance with ancient learning and philoſophy. His illuſtrations of the Scriptures, his labours in defence of Chriſtianity, and the light he caſt upon religion and philoſophy, appear in many volumes of ſacred and profane literature; and his Eccleſiaſtical Hiſtory, from the birth of Chriſt to the beginning of the preſent century, is unqueſtionably the beſt that is extant. This work, written in Latin, has been tranſlated into Engliſh, and accompanied with notes and chronological tables by Archibald Maclaine, D. D. and from this tranſlator's preface to the ſecond edition, 1758, in 5 vols 8vo, this ſhort account is taken.

MOSKITO-COUNTRY, is ſituated in North America, between 85 and 88 degrees of weſt longitude, and between 13 and 15 degrees of north latitude; having the north ſea on the north and eaſt, Nicaragua on the ſouth, and Honduras on the weſt; and indeed the Spaniards eſteem it a part of the principality of Honduras, though they have no colonies in the Moſkito country. When the Spaniards firſt invaded this part of Mexico, they maſſacred the greateſt part of the natives, which gave thoſe that eſcaped into the inacceſſible part of the country an inſuperable averſion to them; and they have always appeared ready to join any Europeans that come upon their coaſts againſt the Spaniards, and particularly the Engliſh, who frequently come hither; and the Moſkito men being excellent markſmen, the Engliſh employ them in ſtriking the maratee fiſh, &c. and many of the Moſkito Indians come to Jamaica, and ſail with the Engliſh in their voyages.

Theſe people are ſo ſituated between moraſſes and inacceſſible mountains, and a coaſt full of rocks and ſhoals, that no attempts againſt them by the Spaniards, whom they mortally hate, could ever ſucceed. Nevertheleſs, they are a mild inoffenſive people, of great morality and virtue, and will never truſt a man who has once deceived them. They have ſo great a veneration towards the Engliſh, that they have ſpontaneouſly put themſelves and their lands under the protection and dominion of the crown of England. This was firſt done when the duke of Albemarle was governor of Jamaica, and the king of the Moſkitos received a commiſſion from his grace, under the ſeal of that iſland; ſince which time they have not only been ſteady in their alliance with the Engliſh, but warm in their affections, and very uſeful to them on many occaſions.

When their king dies, the male heir goes to Jamaica, to certify that he is next in blood, and receives a commiſſion in form from the governor of Jamaica to be king of the Moſkitos, till which he is not acknowledged as ſuch by his countrymen. So fond are theſe people of every thing that is Engliſh, that the common people are proud of every Chriſtian or ſurname given them by our ſeamen, who honour their chief men with the titles of ſome of our nobility.

MOSQUE, a temple or place of religious worſhip among the Mahometans.

All moſques are ſquare buildings, generally conſtructed of ſtone. Before the chief gate there is a ſquare court paved with white marble; and low galleries round it, whoſe roof is ſupported by marble pillars. In theſe galleries the Turks waſh themſelves before they go into the moſque. In each moſque there is a great number of lamps; and between theſe hang many cryſtal rings, oſtriches eggs, and other curioſities, which, when the lamps are lighted, make a fine ſhow. As it is not lawful to enter the moſque with ſtockings or ſhoes on, the pavements are covered with pieces of ſtuff ſewed together, each being wide enough to hold a row of men kneeling, ſitting, or proſtrate. The women are not allowed to enter the moſque, but ſtay in the porches without. About every moſque there are ſix high towers, called *minarets*, each of which has three little open galleries one above another: theſe towers, as well as the moſques, are covered with lead, and adorned with gilding and other ornaments; and from thence, inſtead of a bell, the people are called to prayers by certain officers appointed for that purpoſe. Moſt of the moſques have a kind of hoſpital belonging to them, in which travellers of what religion ſoever are entertained three days. Each moſque has alſo a place called *tarbe*, which is the buryingplace of its founders; within which is a tomb ſix or ſeven feet long, covered with green velvet or ſattin; at the ends of which are two tapers, and round it ſeveral ſeats for thoſe who read the koran and pray for the ſouls of the deceaſed.

MOSS (Dr Robert), dean of Ely, was eldeſt ſon of Mr Robert Moſs, a gentleman in good circumſtances; and was born at Gillingham in Norfolk in 1666. He was bred at Benet-college, Cambridge; and acquired great reputation both as a diſputant and a preacher. He became preacher to the ſociety of Gray's-inn, London, in 1698; and aſſiſtant preacher to Dr Wake at St James's, Weſtminſter, 1699. He was ſworn chaplain in three ſucceeding reigns, to King William, Queen Anne, and George I. and being one of the chaplains in waiting when Queen Anne viſited the univerſity of Cambridge, April 5. 1705, he was then created D. D. In 1708 he was invited by the pariſhioners of St Lawrence Jewry, on the reſignation of dean Stanhope, to accept of their Tueſday lecture, which he held till 1727, and then reſigned it on account

count of his growing infirmities. In 1712, on the death of Dr Roderick, he was nominated by the queen to the deanry of Ely, which was the higheft, but not the laft, promotion he obtained in the church; for in 1714 he was collated, by Robinfon bifhop of London, to Glifton, a fmall rectory on the eaftern fide of Hertfordfhire. The gout deprived him of the ufe of his limbs for fome of the laft years of his life; and he died March 26. 1729, in his 63d year; and was buried in the prefbytery of his own cathedral, under a plain ftone with a fimple infcription. His character may be feen in the preface to the eight volumes of his Sermons, which has ufually been attributed to Dr Snape, the editor of the fermons; but the credit of it has lately been tranferred to Dr Zachary Grey. Dean Mofs is alfo fuppofed to have been the author of a pamphlet printed in 1717, intitled, "The report vindicated from mifreports: being a defence of my lords the bifhops, as well as the clergy of the lower houfe of convocation; in a letter from a member of that houfe to the prolocutor concerning their late confultations about the bifhop of Bangor's writings." He wrote alfo fome poems, both Latin and Englifh.

MOSS, or MOSSES, in botany. See MUSCI.

Moss on Trees, in gardening. The growth of large quantities of mofs on any kind of tree is a diftemper of very bad confequence to its increafe, and much damages the fruit of the trees of our orchards.

The prefent remedy is the fcraping it off from the body and large branches by means of a kind of wooden knife that will not hurt the bark, or with a piece of rough hair cloth, which does very well after a foaking rain. But the moft effectual cure is the taking away the caufe. This is to be done by draining off all the fuperfluous moifture from about the roots of the trees, and may greatly be guarded againft in the firft planting of the trees, by not fetting them too deep.

If trees ftand too thick in a cold ground, they will always be covered with mofs; and the beft way to remedy the fault is to thin them. When the young branches of trees are covered with a long and fhaggy mofs, it will utterly ruin them; and there is no way to prevent it but to cut off the branches near the trunk, and even to take off the head of the tree if neceffary; for it will fprout again: and if the caufe be in the mean time removed by thinning the plantation, or draining the land and ftirring the ground well, the young fhoots will continue clear after this.

If the trees are covered with mofs in confequence of the ground's being too dry, as this will happen from either extreme in the foil, then the proper remedy is the laying mud from the bottom of a pond or river pretty thick about the root, opening the ground to fome diftance and depth to let it in; this will not only cool it, and prevent its giving growth to any great quantity of mofs, but it will alfo prevent the other great mifchief which fruit-trees are liable to in dry grounds, which is the falling off of the fruit too early.

The moffes which cover the trunks of trees, as they always are frefheft and moft vigorous on the fide which points to the north, if only produced on that, ferve to preferve the trunk of the tree from the feverity of the north-winds, and direct the traveller in his way, by always plainly pointing out that part of the compafs.

MOSS is alfo a name given by fome to the boggy ground in many parts of England, otherwife called a *fen* and *bog*.

In many of thefe grounds, as well in England and Ireland as in other parts of the world, there are found vaft numbers of trees ftanding with their ftumps erect, and their roots piercing the ground in a natural pofture as when growing. Many of thofe trees are broken or cut off near the roots, and lie along, and this ufually in a north-eaft direction. People who have been willing to account for this, have ufually refolved it into the effect of the deluge in the days of Noah; but this is a very wild conjecture, and is proved falfe by many unanfwerable arguments. The waters of this deluge might indeed have wafhed together a great number of trees, and buried them under loads of earth; but then they would have lain irregularly and at random; whereas they all lie lengthwife from fouthweft to north-eaft, and the roots all ftand in their natural perpendicular pofture, as clofe as the roots of trees in a foreft.

Befide, thefe trees are not all in their natural ftate, but many of them have the evident marks of human workmanfhip upon them, fome being cut down with an ax, fome fplit, and the wedges ftill remaining in them; fome burnt in different parts, and fome bored through with holes. Thefe things are alfo proved to be of a later date than the deluge, by other matters found among them, fuch as utenfils of ancient people, and coins of the Roman emperors.

It appears from the whole, that all the trees which we find in this foffile ftate, originally grew in the very places where we now find them, and have only been thrown down and buried there, not brought from elfewhere. It may appear indeed an objection to this opinion, that moft of thefe foffile trees are of the fir-kind; and that Cæfar fays exprefsly, that no firs grew in Britain in his time: but this is eafily anfwered by obferving, that thefe trees, though of the fir-kind, yet are not the fpecies ufually called the *fir*, but pitch-tree; and Cæfar has no where faid that pitch-trees did not grow in England. Norway and Sweden yet abound with thefe trees; and there are at this time whole forefts of them in many parts of Scotland, and a large number of them wild upon a hill at Wareton in Staffordfhire to this day.

In Hatfield marfh, where fuch vaft numbers of the foffile trees are now found, there has evidently once been a whole foreft of them growing. The laft of thefe was found alive, and growing in that place within 70 years laft paft, and cut down for fome common ufe.

It is alfo objected by fome to the fyftem of the firs growing where they are found foffile, that thefe countries are all bogs and moors, whereas thefe forts of trees grow only in mountainous places. But this is founded on an error; for though in Norway and Sweden, and fome other cold countries, the fir kinds all grow upon barren and dry rocky mountains, yet in warmer places they are found to thrive as well on wet plains. Such are found plentifully in Pomerania, Livonia, and Courland, &c. and in the weft parts of New England

Moss. England there are vaſt numbers of fine ſtately trees of them in low grounds. The whole truth ſeems to be, that theſe trees love a ſandy ſoil; and ſuch as is found at the bottoms of all the moſſes where theſe trees are found foſſile. The roots of the fir-kind are always found fixed in theſe; and thoſe of oaks, where they are found foſſile in this manner, are uſually found fixed in clay: ſo that each kind of tree is always found rooted in the places where they ſtand in their proper ſoil; and there is no doubt to be made but that they originally grew there. When we have thus found that all the foſſile trees we meet with once grew in the places where they are now buried, it is plain that in theſe places there were once noble foreſts, which have been deſtroyed at ſome time; and the queſtion only remains how and by whom they were deſtroyed. This we have reaſon to believe, by the Roman coins found among them, was done by the people of that empire, and that at the time when they were eſtabliſhed or eſtabliſhing themſelves here.

Their own hiſtorian tells us, that when their armies purſued the wild Britons, theſe people always ſheltered themſelves in the miry woods and low watery foreſts. Cæſar expreſsly ſays this; and obſerves, that Caſſibelan and his Britons, after their defeat, paſſed the Thames, and fled into ſuch low moraſſes and woods, that there was no purſuing them: and we find that the Silures ſecured themſelves in the ſame manner when attacked by Oſtorius and Agricola. The ſame thing is recorded of Venutius king of the Brigantes, who fled to ſecure himſelf into the boggy foreſts of the midland part of this kingdom: and Herodian expreſsly ſays, that in the time of the Romans puſhing their conqueſts in theſe iſlands, it was the cuſtom of the Britons to ſecure themſelves in the thick foreſts which grew in their boggy and wet places, and when opportunity offered, to iſſue out thence and fall upon the Romans. The conſequence of all this was the deſtroying all theſe foreſts; the Romans finding themſelves ſo plagued with parties of the natives iſſuing out upon them at times from theſe foreſts, that they gave orders for the cutting down and deſtroying all the foreſts in Britain which grew on boggy and wet grounds. Theſe orders were punctually executed; and to this it is owing that at this day we can hardly be brought to believe that ſuch foreſts ever grew with us as are now found buried.

The Roman hiſtories all join in telling us, that when Suetonius Paulinus conquered Angleſea, he ordered all the woods to be cut down there, in the manner of the Roman generals in England: and Galen tells us, that the Romans, after their conqueſt in Britain, kept their ſoldiers conſtantly employed in cutting down foreſts, draining of marſhes, and paving of bogs. Not only the Roman ſoldiers were employed in this manner, but all the native Britons made captives in the wars were obliged to aſſiſt in it: and Dion Caſſius tells us, that the emperor Severus loſt no leſs than 50,000 men in a few years time in cutting down the woods and draining the bogs of this iſland. It is not to be wondered at, that ſuch numbers executed the immenſe deſtruction which we find in theſe buried foreſts. One of the greateſt ſubterranean treaſures of wood is that near Hatfield; and it is eaſy to prove, that theſe people, to whom this havock is thus attributed, were upon the ſpot where theſe trees now lie buried. The common road of the Romans out of the ſouth into the north, was formerly from Lindum (Lincoln), to Segelochum (Little Burrow upon Trent), and from thence to Danum (Doncaſter), where they kept a ſtanding garriſon of Criſpinian horſe. A little off on the eaſt, and north-eaſt of their road, between the two laſt named towns, lay the borders of the greateſt foreſt, which ſwarmed with wild Britons, who were continually making their ſallies out, and their retreats into it again, intercepting their proviſions, taking and deſtroying their carriages, killing their allies and paſſengers, and diſturbing their garriſons. This at length ſo exaſperated the Romans, that they were determined to deſtroy it; and to do this ſafely and effectually, they marched againſt it with a great army, and encamped on a great moor not far from Finningly: this is evident from their fortifications yet remaining.

There is a ſmall town in the neighbourhood called *Oſterfield;* and as the termination *field* ſeems to have been given only in remembrance of battles fought near the towns whoſe names ended with it, it is not improbable that a battle was fought here between all the Britons who inhabited this foreſt and the Roman troops under Oſtorius. The Romans ſlew many of the Britons, and drove the reſt back into this foreſt, which at that time overſpread all this low country. On this the conquerors taking advantage of a ſtrong ſouth-weſt wind, ſet fire to the pitch-trees, of which this foreſt was principally compoſed; and when the greater part of the trees were thus deſtroyed, the Roman ſoldiers and captive Britons cut down the remainder, except a few large ones which they left ſtanding as remembrances of the deſtruction of the reſt. Theſe ſingle trees, however, could not ſtand long againſt the winds, and theſe falling into the rivers which ran through the country, interrupted their currents; and the water then overſpreading the level country, made one great lake, and gave origin to the moſſes or moory bogs, which were afterwards formed there, by the workings of the waters, the precipitation of earthy matter from them, and the putrefaction of rotten boughs and branches of trees, and the vaſt increaſe of water-moſs and other ſuch plants which grow in prodigious abundance in all theſe ſorts of places. Thus were theſe burnt and felled trees buried under a new-formed ſpongy and watery earth, and afterwards found on the draining and digging through this earth again.

Hence it is not ſtrange that Roman weapons and Roman coins are found among theſe buried trees; and hence it is that among the buried trees ſome are found burnt, ſome chopped and hewn; and hence it is that the bodies of the trees all lie by their proper roots, and with their tops lying north-eaſt, that is, in that direction in which a ſouth-weſt wind would have blown them down: hence alſo it is, that ſome of the trees are found with their roots lying flat, theſe being not cut or burned down, but blown up by the roots afterwards when left ſingle; and it is not wonderful, that ſuch trees as theſe ſhould have continued to grow even after their fall, and ſhoot up branches from their ſides which might eaſily grow into high trees. Phil. Tranſ. N° 275.

By this ſyſtem it is alſo eaſily explained why the moor

Mofs. moor foil in the country is in fome places two or three yards thicker than in others, or higher than it was formerly, fince the growing up of peat-earth or bog-ground is well known, and the foil added by overflowing of waters is not a little.

As the Romans were the deftroyers of this great and noble foreft, fo they were probably alfo of the feveral other ancient forefts; the ruins of which furnifhes us with the bog-wood of Staffordfhire, Lancafhire, Yorkfhire, and other counties. But as the Romans were not much in Wales, in the Ifle of Man, or in Ireland, it is not to be fuppofed that forefts cut down by thefe people gave origin to the foffile wood found there; but though they did not cut down thefe forefts, others did; and the orgin of the bog-wood is the fame with them and with us. Holingfhead informs us, that Edward I. being not able to get at the Welch becaufe of their hiding themfelves in boggy woods, gave orders at length that they fhould all be deftroyed by fire and by the axe; and doubtlefs the roots and bodies of trees found in Pembrokefhire under ground, are the remains of the execution of this order. The foffile wood in the bogs of the ifland of Man is doubtlefs of the fame origin, though we have not any accounts extant of the time or occafion of the forefts there being deftroyed; but as to the foffile trees of the bogs of Ireland, we are exprefsly told, that Henry II. when he conquered that country, ordered all the woods to be cut down that grew in the low parts of it, to fecure his conquefts, by cutting away the places of refort of rebels.

Moving-MOSS. We have an account in the Philofophical Tranfactions of a moving mofs near Churchtown in Lancafhire, which greatly alarmed the neighbourhood as miraculous. The mofs was obferved to rife to a furprifing height, and foon after funk as much below the level, and moved flowly towards the fouth.

A very furprifing inftance of a moving mofs is that of Solway in Scotland, which happened in the year 1771, after fevere rains which had produced terrible inundations of the rivers in many places. For the better underftanding of this event, we fhall give the following defcription of the fpot of ground where it happened. Along the fide of the river Efk there is a vale, about a mile broad, lefs or more in different places. It is bounded on the fouth-eaft by the river Efk, and on the north-weft by a fteep bank 30 feet in height above the level of the vale. From the top of the bank the ground rifes in an eafy afcent for about a quarter of a mile, where it is terminated by the mofs; which extends about two miles north and fouth, and about a mile and an half eaft and weft, and is bounded ou the north-weft by the river Sark. It is probable that the folid ground from the top of the bank above the vale was continued in the fame direction under the mofs, before its eruption, for a confiderable fpace; for the mofs at the place where the eruption happened, was inclined towards the floping ground. From the edge of the mofs there was a gully or hollow, called by the country people *the gap*, and faid to be 30 yards deep where it entered the vale; down which ran a fmall rill of water, which was often dry in fummer, having no fupply but what filtered from the mofs. The eruption happened at the head of this gap, on Saturday November 16th 1771, about ten or eleven at night, when all the neighbouring rivers and brooks were prodigioufly fwelled by the rains. A large body of the mofs was forced, partly by the great fall of rain, and partly by fome fprings below it, into a fmall beck or burn, which runs within a few yards of its border to the fouth-eaft. By the united preffure of the water behind it, and of this beck, which was then very high, it was carried down a narrow glen between two banks about 300 feet high, into a wide and fpacious plain, over part of which it fpread with great rapidity. The mofs continued for fome time to fend off confiderable quantities; which, being borne along by the torrent on the back of the firft great body, kept it for many hours in perpetual motion, and drove it ftill farther on. This night at leaft 400 acres of fine arable land were covered with mofs from 3 to 12 or 15 feet deep. Several houfes were deftroyed, a good deal of corn loft, &c. but all the inhabitants efcaped. When the waters fubfided, the mofs alfo ceafed to flow; but two pretty confiderable ftreams continued to run from the heart of it, and carried off fome pieces of moffy matter to the place where it burft. There they joined the beck already mentioned; which, with this addition, refumed its former channel; and, with a little affiftance from the people of the neighbourhood, made its way to the Efk, through the midft of that great body of mofs which obftructed its courfe. Thus, in a great meafure drained, the new mofs fell feveral feet, when the fair weather came in the end of November, and fettled in a firmer and more folid body on the lands it had over-run. By this inundation about 800 acres of arable ground were overflowed before the mofs ftopped, and the habitations of 27 families deftroyed. Tradition has preferved the memory of a fimilar inundation in Monteith in Scotland. A mofs there altered its courfe in one night, and covered a great extent of ground.

MOSS *of* Kincardine: A remarkable tract of ground in the fhire of Perth in Scotland, which deferves particular notice, not merely as a topographical curiofity, or as a fubject of natural hiftory; but for the information, equally uncommon and important, which it affords, refpecting agricultural improvement, and the promotion of induftry and population.

The mofs of Kincardine is fituated in the parifh of the fame name, comprehended between the rivers Forth and Teith, and in that diftrict of Perthfhire called *Monteith*. The mofs begins about a mile above the confluence of thefe rivers; from thence it extends in length about four miles, and from one to two in breadth; and before the commencement of the operations (an account of which is to be given), comprehended near 2000 Scotch acres, of which about 1500 belong to the eftate of Blair Drummond, the property of Lord Kames by his marriage with Mrs Drummond of Blair Drummond.

As moffes are extremely various in their nature; before entering upon the improvements made in Kincardine mofs, it will be proper to give a fhort defcription of that mofs, and of the fubjacent foil which is the object of thofe improvements.

The mofs lies upon a field of clay, which is a continuation of thofe rich, extenfive flats in the neighbourhood

bourhood of Falkirk and Stirling, diftinguifhed by the name of *carfes*. This clay, which is one uniform homogeneous mafs finking to a great depth, is found near the furface, confifts of different colours, and is difpofed in layers. The uppermoft is grey; the next is reddifh; and the loweft, which is the moft fertile, is blue. Through the whole mafs not a pebble is to be found. The only extraneous bodies it contains are fea-fhells, which occur in all the varieties peculiar to the eaftern coaft of Scotland. They are difpofed fometimes in beds, fometimes fcattered irregularly at different depths. By attending to thefe circumftances, it cannot be doubted that the fea has been the means of the whole accumulation, and that it was carried on in a gradual manner by the ordinary ebb and flow of the tide. Upon any other fuppofition, why fhould there not have been a congeries of all the different materials that compofe the furface of the furrounding heights? But to whatever caufe the origin of this accumulation may be afcribed, certain it is that no foil whatever is more favourable to vegetation, or carries more abundant crops of every kind.

The furface of the clay, which, upon the retreat of the fea, had been left in an almoft level plane, is every where thickly covered with trees, chiefly oak and birch, many of them of a great fize. Thefe trees feem to have been the firft remarkable produce of the carfe; and it is probable they were propagated by diffemination from the furrounding eminences. They are found lying in all directions befide their roots, which ftill continue firm in the ground in their natural pofition; and from impreffions ftill vifible, it is evident they have been cut with an axe or fome fimilar inftrument. For the cutting of wood, the two common purpofes are, either to apply it to its proper ufe, or that the ground it occupies may be cultivated. In the prefent cafe, however, neither of thefe ends had been propofed, fince the trees, by being left juft as they were cut, were not only entirely loft, but the ground was rendered totally unfit for cultivation. Hence it is evident, that the downfal of this wood muft be afcribed to fome more extraordinary caufe; and to none more probably than to that expedient, which, as we learn from Dion Caffius and other hiftorians, the Romans put fo extenfively in practice to diflodge from their forefts the ancient inhabitants of the Britifh iflands.

This hypothefis acquires no fmall degree of force from a circumftance that occurred in May 1768, when a large round veffel of thin brafs and curious workmanfhip, 25 inches in diameter and 16 inches in height, was difcovered upon the furface of the clay buried under the mofs. This veffel, found upon the eftate of John Ramfay, Efq; of Ochtertyre, was by that gentleman prefented to the Antiquarian Society of Edinburgh; in whofe mufeum it remains depofited for prefervation. And in a lift of the various donations prefented to that fociety, publifhed by them in 1782, it is there denominated a *Roman camp-kettle*.

Between the clay and the mofs is found a ftratum nine inches thick, partly dark brown and partly of a colour approaching to black. This is a vegetable mould, accumulated probably by the plants that covered the ground previous to the growth of the wood, and by leaves from the trees thereafter. The difference of colour muft be owing to a difference in the vegetable fubftances that compofe it. The brown mould is highly fertile; the other, efpecially in a dry feafon, is very unproductive. The crop that had occupied this mould when the trees were felled is found ftill entire. It confifts chiefly of heath; but feveral other fmaller plants are alfo very diftinguifhable.

Immediately above this ftratum lies the mofs, to the height, upon an average, of feven feet. It is compofed of different vegetables arranged in three diftinct ftrata. Of thefe the firft is three feet thick. It is black and heavy, and preferable to the others for the purpofe of fuel. It confifts of bent-grafs (*agroftis*), which feems to have grown up luxuriantly among the trees after they were felled. The fecond ftratum alfo is three feet thick. It is compofed of various kinds of moffes, but principally of bog-mofs (*fphagnum*). It is of a fallow or iron colour, and remarkably elaftic. It is commonly called *white-peat*; and for fuel is confidered as much inferior to that above mentioned. The third ftratum is compofed of heath and a little bent-grafs, but chiefly of the deciduous parts of the former. It is about a foot thick, and black.

Three ftrata of different vegetables lying above each other, the limits of each diftinctly marked, and each diftinguifhed by a different colour, is certainly a curious natural phenomenon.

An inquiry will here occur, What has occafioned this fucceffion in the vegetables of which the mofs is compofed?

Every vegetable has a particular foil, more or lefs moift, peculiarly adapted to its nature. Let a piece of ground be in a moift ftate, rufhes will introduce themfelves; drain the ground fufficiently, the rufhes will difappear, and finer vegetables will fucceed. It feems reafonable to account for the fucceffion of the different plants that compofe the mofs on fimilar principles.

Let us imagine an extenfive plain covered with trees lying in all directions, full of branches, and poffibly loaded with leaves. This it is evident would produce a great ftagnation of water, which, as the crops of bent-grafs accumulated, would ftill increafe: and the probability is, that at length it had fo increafed, as to be the caufe why the bent-grafs and other congenial plants of the firft ftratum ceafed to grow. But it is evident that a plant was to be found that could live in fuch a fituation. Accordingly we fee that bog-mofs had eftablifhed itfelf; a plant that loves even to fwim in water.

When the accumulations of bent-grafs and the moffes had, in procefs of time, arifen to the height of fix feet above the furrounding *carfe* ground, the water that fell upon the furface had by that means an opportunity to difcharge itfelf. It has accordingly formed many channels, which are often three feet deep; and the intermediate furface being wholly turned into little hillocks has become dry and firm. By this means it became unfit for moffes, and heath fucceeded.

Such feems to have been the procefs in the formation of what is now called *a mofs*.

By far the greateft part of the mofs in queftion is, upon an average, full feven feet deep, and has in all probability lain undifturbed fince its formation: this is called the *High Mofs*. The remainder, called the *Low Mofs*, lies to a confiderable breadth around the extremities of the high; and is, upon an average, not above three feet in

I depth,

Mofs.

depth, to which it has been reduced by the digging of peats. Thefe are formed of that ftratum of the mofs only that lies four feet below the furface and downwards; the reft is improper for the purpofe, and is thrown afide.

Before the introduction of the plan which is now purfued, two methods chiefly were employed to gain land from the mofs. 1ft, The furrounding farmers marked off yearly a portion of the Low Mofs next to their arable land, about 15 feet broad. This they removed with carts and fpread upon their fields, fome acres of which they for that end left unfown. Here it lay till May or June; when, being thoroughly dry, it was burnt to afhes to ferve as a manure. By this means they added to their farms about half a rood of land yearly. But this plan proved unfuccefsful; for by the repeated application of thefe afhes, the foil was rendered fo loofe that the crops generally failed. 2dly, Many farmers were wont to *trench down* the low mofs, and to cover it *furrow deep* with clay taken out of the trench. This, though commendable as an attempt to improve, proved likewife an unavailing method; becaufe in a dry feafon the fuperficial covering of clay retains fo little moifture that the crop commonly fails.

It has been attempted to cover the mofs with clay brought from the adjacent grounds. But what from the neceffary impoverifhment of the ground from which the clay was carried, and the foftnefs of the mofs, this was foon found to be impracticable.

Draining has alfo been propofed as another mode of improvement; and it muft be acknowledged, that, by means of draining, many moffes have been converted both into arable and meadow grounds, which in the end became interefting improvements. But in a mofs, fuch as that of Kincardine, this method would be ineffectual; as for feveral feet deep it is of fuch a nature, that upon being dry and divided into parts, it would blow with the wind like chaff; and when thrown afide in the operation of digging peats, it lies for years without producing a fingle vegetable, except only a few plants of forrel.

Hence it is evident, that all attempts to *improve* this mofs muft ever prove abortive; and that the object to be had in view is the acquifition of the valuable foil lying underneath; to which end nothing lefs is requifite than the total abolition of the mofs.

By the methods above defcribed from 100 to 200 acres of mofs had been removed. When the prefent plan was introduced, there ftill remained covered with mofs from 1300 to 1400 acres of carfe clay—a treafure for which it muft be ever interefting to dig.

In the year 1766 Lord Kames entered into poffeffion of the eftate of Blair Drummond. Long before that period he was well acquainted with the mofs, and often lamented that no attempt had ever been made to turn it to advantage. Many different plans were now propofed; at length it was refolved to attempt, by means of water as the moft powerful agent, entirely to fweep off the whole body of mofs.

That mofs might be floated in water, was abundantly obvious; but to find water in fufficient quantity was difficult, the only ftream at hand being employed to turn a corn-mill. Convinced of the fuperior confequence of dedicating this ftream to the purpofe of floating off the mofs, Lord Kames having made an agreement with the tenant who farmed the mill, and the tenants thirled confenting to pay the rent, he immediately threw down the mill, and applied the water to the above purpofe.

Mofs.

In order to determine the beft manner of conducting the operation, workmen were now employed for a confiderable time upon the Low Mofs both by the day and by the piece, to afcertain the expence for which a given quantity of mofs could be removed. It was then agreed to operate at a certain rate per acre; and in this manner feveral acres were removed.

But this was to be a very expenfive procefs. The ground gained might, indeed, be afterwards let to tenants; but every acre would require an expenditure from 12 l. to 15 l. before it could be ready for fowing; fo that the acquifition of the whole, computing it at a medium to be 1350 acres, would fink a capital of nearly 20,000 l. Sterling.

One other method ftill remained; namely, to attempt letting portions of the mofs, as it lay, for a term of years fufficient to indemnify tenants for the expences incurred in removing it. For fome time both thefe plans were adopted; but feveral reafons made the latter preferable. 1. The quantity of water to be had was fmall; and being alfo uncertain, it was very inconvenient for an undertaker; neither were there any houfes near the fpot, which occafioned a great lofs of time in going and coming: but when a man fhould live upon the fpot, then he could be ready to feize every opportunity. 2. The mofs was an ufelefs wafte. To let it to tenants would increafe the population of the eftate, and afford to a number of induftrious people the means of making to themfelves a comfortable livelihood.

In the mean time it was determined, till as many tenants fhould be got as could occupy the whole water, to carry on the work by means of undertakers.

But before proceeding farther, it will be neceffary to defcribe the manner of applying water to the purpofe of floating the mofs.

A ftream of water fufficient to turn a common corn-mill will carry off as much mofs as 20 men can throw into it, provided they be ftationed at the diftance of 100 yards from each other. The firft ftep is to make in the clay, along-fide of the mofs, a drain to convey the water: and for this operation the carfe-clay below the mofs is peculiarly favourable, being perfectly free from ftones and all other extraneous fubftances, and at the fame time, when moift, flippery as foap; fo that not only is it eafily dug, but its lubricity greatly facilitates the progrefs of the water when loaded with mofs. The dimenfions proper for the drain are found to be two feet for the breadth and the fame for the depth. If fmaller, it could not conveniently receive the fpadefuls of mofs; if larger, the water would efcape, leaving the mofs behind. The drain has an inclination of one foot in 100 yards: the more regularly this inclination is obferved throughout, the lefs will the mofs be liable to obftructions in its progrefs with the water. The drain being formed, the operator marks off to a convenient extent along-fide of it a fection of mofs 10 feet broad; the greateft diftance from which he can heave his fpadeful into the drain. This he repeatedly does till the entire mafs be removed down to the clay. He then digs a new drain at the foot of the

Mofs. the mofs-bank, turns the water into it, and proceeds as before, leaving the mofs to purfue its courfe into the river Forth, a receptacle equally convenient and capacious; upon the fortunate fituation of which, happily forming for feveral miles the fouthern boundary of the eftate, without the interpofition of any neighbouring proprietor, depended the very exiftence of the whole operations.

When the mofs is entirely removed, the clay is found to be encumbered with the roots of different kinds of trees ftanding in it as they grew, often very large: their trunks alfo are frequently found lying befide them. All thefe the tenants remove often with great labour. In the courfe of their operations they purpofely leave upon the clay a ftratum of mofs fix inches thick. This, in fpring, when the feafon offers, they reduce to afhes, which in a great meafure enfures the firft crop. The ground thus cleared is turned over, where the drynefs admits, with a plough, and, where too foft, with a fpade. A month's expofure to the fun, wind, and froft, reduces the clay to a powder fitting it for the feed in March and April. A crop of oats is the firft, which feldom fails of being plentiful, yielding from eight to ten bolls after one.

In the year 1767 an agreement was made with one tenant for a portion of the Low Mofs. This, as being the firft ftep towards the intended plan, was then viewed as a confiderable acquifition. The fame terms agreed upon with this tenant have ever fince been obferved with all the reft. They are as follow:

The tenant holds eight acres of mofs by a tack of 38 years; he is allowed a proper quantity of timber, and two bolls of oatmeal to fupport him while employed in rearing a houfe; the firft feven years he pays no rent; the eighth year he pays one merk Scots; the ninth year two merks; and fo on with the addition of one merk yearly till the end of the firft 19 years; during the laft five years of which he alfo pays a hen yearly. Upon the commencement of the fecond 19 years, he begins to pay a yearly rent of 12s. for each acre of land cleared from mofs, and 2s. 6d. for each acre not cleared, alfo two hens yearly: A low rent indeed for fo fine a foil; but no more than a proper reward for his laborious exertions in acquiring it.

In the year 1768 another tenant was fettled. Thefe two were tradefmen; to whom the preference was always given, as having this great advantage to recommend them, that even when deprived of water they need never want employment. The motives that induced thefe people to become fettlers were, *1ft*, The profpect of an independent eftablifhment for a number of years. *2dly*, The mofs afforded them great abundance of excellent fuel; to which was added the comfortable confideration, that, while bufied in providing that neceffary article, they had the double advantage of promoting, at the fame time, the principal object of their fettlement.

Notwithftanding thefe inducements, ftill fettlers offered flowly; to which two circumftances chiefly contributed: *1ft*, The whole farmers furrounding the mofs threw every poffible obftruction in their way. *2dly*, By people of all denominations the fcheme was viewed as a chimerical project, and became a common topic of ridicule. The plan, however, fupported itfelf; and in the year 1769 five more tenants agreed for eight acres each; and thus 56 acres of Low Mofs were dif- Mofs. pofed of. From the progrefs made by the firft fettlers, and the addition of thefe, the obloquy of becoming a mofs-tenant gradually became lefs regarded; fo that in the year 1772 two more were added; in 1773, three; and in 1774, one; in all 13: which difpofed of 104 acres; all the Low Mofs to which water could then be conveyed. As water is the main fpring of the operation, every tenant, befide the attention neceffary to his fhare of the principal ftream, collected water by every poffible means, making ditches round his portion of the mofs, and a refervoir therein to retain it till wanted.

The tenants in the Low Mofs having now begun to raife good crops, in the year 1774 feveral perfons offered to take poffeffions in the High Mofs, upon condition that accefs to it fhould be rendered practicable. The High Mofs wanted many advantages that the Low poffeffed. To the Low Mofs, lying contiguous to the furrounding arable lands, the accefs was tolerably good; but from the arable lands the High Mofs was feparated by 300 or 400 yards of the Low, which, even to a man, affords but indifferent footing, and to horfes is altogether impracticable. The Low Mofs is in general only three feet deep; the High Mofs is from fix to twelve feet in depth.

It will appear at firft fight, that without a road of communication the High Mofs muft for ever have proved unconquerable. Without delay, therefore, a road was opened to the breadth of twelve feet, for feveral hundred yards in length, by floating off the mofs down to the clay.

This being effected, and at the fame time an opening given to admit water, in the year 1775 twelve tenants agreed for eight acres of high mofs each. In confideration of the greater depth of this part of the mofs, it was agreed, that during the firft 19 years they fhould pay no rent; but for the fecond 19 years the terms of agreement were the fame as thofe made with the tenants in the Low Mofs. To the above mentioned tenants every degree of encouragement was given; as upon their fuccefs depended, in a great meafure, the difpofal of the great quantity of mofs ftill remaining. But their fuccefs, however problematical, was fuch, that next year,

1776, 6 more took 8 acres each,
1777, 1
1778, 4
1779, 3
1780, 1
1781, 1
1782, 1

In all, including thofe upon the Low Mofs, 42 tenants, occupying 336 acres.

Though for fome time the difpofal of the Hgh Mofs went but flowly on, it was not for want of tenants; but the number of operators was already fufficient for the quantity of water; to have added more would evidently have been imprudent.

In the year 1783 Mr Drummond entered into poffeffion of the eftate of Blair-Drummond, and went fully into the plan adopted by his predeceffor for fubduing the mofs. At this time there ftill remained undifpofed of about 1000 acres of High Mofs. As water was the great defideratum, it was determined, that

Mofs. that to obtain that neceffary article neither pains nor expence fhould be wanting. Steps were accordingly taken to afcertain in what manner it might be procured to moft advantage.

Meanwhile, to prepare for new tenants a fecond road parallel to the former, at the diftance of half a mile, was immediately begun and cut, with what water could be got, down to the clay, 12 feet broad and 2670 yards long, quite acrofs the mofs. This opening was previoufly neceffary, that operators might get a drain formed in the clay to direct the water; and it was to remain as a road that was abfolutely neceffary, and which relieved fettlers from an expence they were unable to fupport. Thefe preparations, the progrefs of the former tenants, and the profpect of a farther fupply of water, induced 10 more to take poffeffions in the year 1783; in the year 1784, 18 more took poffeffions; and in 1785 no fewer than 27;—in all, 55 tenants in three years, which difpofed of 440 acres more of the High Mofs.

As the introduction of an additional ftream to the mofs was to be a work both of nicety and expence, it was neceffary to proceed with caution. For this reafon feveral engineers were employed to make furveys and plans of the different modes by which it might be procured. In one point they all agreed, that the proper fource for furnifhing that fupply was the river Teith; a large and copious ftream that paffes within a mile of the mofs: but various modes were propofed for effecting that purpofe.

To carry a ftream from the river by a cut or canal into the mofs was found to be impracticable; and Mr Whitworth (A) gave in a plan of a pumping machine, which he was of opinion would anfwer the purpofe extremely well.

Soon after this Mr George Meikle of Alloa, a very fkilful and ingenious mill-wright, gave in a model of a wheel for raifing water entirely of a new conftruction, of his own and his father's invention jointly. This machine is fo exceedingly fimple, and acts in a manner fo eafy, natural, and uniform, that a common obferver is apt to undervalue the invention: But perfons fkilled in mechanics view machinery with a very different eye; for to them fimplicity is the firft recommendation a machine can poffefs. Accordingly, upon feeing the model fet to work, Mr Whitworth, with that candour and liberality of mind that generally accompany genius and knowledge, not only gave it the greateft praife, but declared that, for the purpofe required, it was fuperior to the machine recommended by himfelf, and advifed it to be adopted without hefitation.

The better to explain this machine, two fketches are annexed, to the firft of which the following letters refer. The explanation of the fecond will be found upon the fketch.

Plate CCCXVI. *a*. Sluice through which is admitted the water that moves the wheel.

b, *b*. Two fluices through which is admitted the water raifed by the wheel.

Mofs. *c*, *c*. A part of one of two wooden troughs and an aperture in the wall, through which the above water is conveyed into the buckets. [The other trough is hid by two ftone walls that fupport the wheel.]

d, *d*, *d*. Buckets, of which 80 are arranged on each fide of the arms of the wheel = 160.

e, *e*, *e*. A ciftern, into which the water raifed by the buckets is difcharged.

f, *f*, *f*. Wooden barrel-pipes, through which the water defcends from the ciftern underground, to avoid the high road from Stirling and the private approach to the houfe.

Sketch fecond contains a plan of the ciftern, and exhibits the manner in which the water is filled into the buckets.

The diameter of the wheel to the extremities of the float-boards is 28 feet; the length of the float-boards, 10 feet. The wheel makes nearly four revolutions *per* minute; in which time it difcharges into the ciftern 40 hogfheads of water. But this is not all the wheel is capable of performing; for by feveral accurate trials by Meffrs Whitworth and Meikle, in the refult of which, though made feparately, they perfectly agreed, it was found that the wheel was able to lift no lefs than 60 hogfheads *per* minute; but that the diameter of the pipes through which the water defcends from the ciftern would not admit a greater quantity than what they already receive.

To a perfon at all converfant in hydraulics, the refemblance of this to the Perfian wheel muft be obvious: and indeed it is probable, that from the Perfian wheel the firft idea of this machine was derived. But admitting this, ftill the fuperiority of the prefent wheel is, in moft refpects, fo confpicuous, as to entitle it to little lefs praife than the firft invention. For, 1ft, In the Perfian wheel, the buckets being all moveable, muft be conftantly going out of order: In this wheel they are all immoveable, confequently never can be out of order. 2dly, Inftead of lifting the water from the bottom of the fall as in the Perfian wheel, this wheel lifts it from the top of the fall, being from four to five feet higher; by which means fome additional power is gained. 3dly, By means of the three fluices (*a*, and *b*, *b*, fig. 1.) in whatever fituation the river may be, the quantity of the water to be raifed is fo nicely adjufted to that of the moving power, as conftantly to preferve the wheel in a fteady and equable motion. In fhort, as a regulator is to a watch, fo are thefe fluices to this wheel, whofe movements would otherwife be fo various, as fometimes to carry the water clear over the ciftern, fometimes to drop it entirely behind, but feldom fo as fully to difcharge the whole contents of the buckets into the ciftern.

It is however but candid to remark, that this machine labours under a fmall defect, which did not efcape the obfervation of Mr Whitworth; namely, that by raifing the water about $3\frac{1}{2}$ feet higher than the ciftern where it is ultimately delivered, a fmall degree of power is loft. To this indeed he propofed a remedy; but candidly confeffed, that, as it would render the machine

 fome-

(A) This gentleman is fuperintendant of the London water-works, and an engineer of great reputation in England. He was feveral years employed in Scotland in completing the great canal.

Mofs.

fomewhat more complex, and would alfo increafe the friction, he thought it more advifable to keep it in its prefent ftate. At the fame time he juftly obferved, that as the ftream by which the wheel is moved is at all times copious and powerful, the fmall lofs of power occafioned by the above circumftances was of little or no avail.

This ftream is detached from the Teith at the place where that river approaches neareft to the mofs. The furface of the latter is about 15 feet higher than that of the former; the ciftern is therefore placed 17 feet above the furface of the ftream, fo as to leave a declivity fufficient to deliver the water upon the furface of the mofs.

The pipes through which the water defcends from the ciftern are compofed of wooden barrels hooped with iron 4 feet long and 18 inches in diameter within.

In thefe pipes, having been conveyed under ground for 354 yards from the ciftern, the water at once emerges into an open aqueduct. This aqueduct, which was formed according to a plan by Mr Whitworth, is conftructed wholly of earth or clay; and in order to keep the water on a level with the furface of the mofs, it is for nearly two-thirds of its courfe elevated from 8 to 10 feet above the level of the adjacent grounds; the bafe being 40 feet broad, the fummit 18 feet, and the water-courfe 10 feet broad. It commences at the termination of the pipes; from whence extending above 1400 yards, it difcharges the water into a canal formed for its reception on the furface of the mofs.

For raifing the water to this height there were two reafons. 1ft, That not only where it was delivered on the mofs, but even after being conveyed to the moft diftant corners, it might ftill retain fufficient power to tranfport the mofs to the river Forth. 2dly, That refervoirs of a fufficient height might be formed in the mofs to retain the water delivered during night.

In confequence of Mr Whitworth's advice, a contract was entered into with Mr Meikle in fpring 1787; and by the end of October in that year, the wheel, pipes, and aqueduct, were all completely finifhed: and what, in fo complex and extenfive an undertaking, is by no means common, the different branches of the work were fo completely executed, and fo happily adjufted to each other, that upon trial the effect anfwered the moft fanguine expectations. The total expence exceeded L. 1000 Sterling.

To induce the proprietor to embark in this undertaking, the mofs tenants had of their own accord previoufly come under a formal engagement to pay the intereft of any fum that might be expended in procuring a fupply of water. But he was determined they fhould not enjoy by halves the fweets of this long-wifhed-for acquifition. With a view, therefore, not only to reward their paft induftry, but to roufe them to future exertions, he at once fet them free from their engagement; nor has any intereft ever been demanded.

This new fupply was a moft acceptable boon to the mofs tenants.—In order to make an equitable diftribution, the water raifed through the day was allotted to one divifion of operators; that raifed during the night to another. To retain the latter, a canal was formed, extending almoft three miles through the centre of the mofs. From place to place along the fides are inferted fluices to admit water to the refervoirs of the poffeffors; each fluice having an aperture proportioned to the number of operators to be fupplied from the refervoir which it fills. For the water raifed through the day no refervoirs are neceffary; as it is immediately ufed by the divifion to which it is allotted.

This additional ftream, though highly beneficial, yet is not more than fufficient to keep 40 men at conftant work. But fuch a quantity as would give conftant work is not neceffary; the operators muft be often employed in making and repairing their drains, grubbing up roots of trees, &c.; fo that a quantity fufficient to give five or fix hours work *per* day to the whole inhabitants is as much as would be wanted. But as the quantity procured was ftill infufficient for this purpofe, a fmall ftream that defcended from the higher grounds was diverted from its courfe and brought into the mofs. From want of level this ftream could not be delivered to the greateft advantage; namely, upon the furface of the mofs. Yet by making, at a confiderable expence, a drain half a mile long, and a refervoir for the night-water, it was rendered of much importance. And during the whole winter months, as well as in fummer, after every fall of rain, it keeps 15 perfons fully employed.

In the year 1787 two more tenants agreed for eight acres each; in 1788, four; in 1789, eight; in 1790, four tenants, all agreed for the fame number of acres.

The whole mofs was now difpofed of, except that part called *Flow-mofs*, which comprehended about 400 acres. Here it is twice the ufual breadth, fo fluid that a pole may be thruft with one hand to the bottom; and the interior part, for near a mile broad, is three feet above the level of all the reft of the mofs. Hitherto the many and various difficulties that prefented themfelves had been overcome by perfeverance and expence. But here the extraordinary elevation of the morafs, joined to its great fluidity, feemed to exclude all poffibility of admitting a ftream of water; and it was the general opinion that the mofs-operations had now arrived at their *ne plus ultra*, and that this morafs was doomed to remain a nuifance for ages to come.

But the proprietor had now advanced fo far that he could not fubmit to retreat; and he confidered himfelf as, in fome meafure, pledged to the country for the completion of this undertaking. To detail the various methods practifed to introduce a ftream of water into that morafs, would prove tedious. It is fufficient to fay, that after a thoufand unfuccefsful efforts, attended with much trouble and confiderable expence, the point at laft was gained, and a ftream of water was brought in, and carried fairly acrofs the centre of the morafs.

The greateft obftacle was now indeed overcome; but ftill another remained of no fmall moment, namely, the difcouragement given to fettlers from the total impoffiblity of erecting habitations upon the furface of this morafs. To find a remedy for this evil was difficult. Happily a refource at laft occurred. This was to bargain with a certain number of the old tenants whofe habitations were neareft, to take leafes of portions of the morafs. But as fome additional aid was here neceffary, it was agreed that L. 12 Sterling fhould be gradually advanced to each tenant till he fhould accomplifh the clearing of an acre, for which he or his fucceffor is bound to pay 12s. of yearly rent,

4 equal

Moss. equal to five *per cent.* upon the sum advanced. When this point shall be gained, they are bound to dispose, as most agreeable to themselves, either of their old or of their new possession; for which, when once an acre is cleared, purchasers will not be wanting.

In consequence of the above arrangement, during the year 1791 no fewer than 35 of the old tenants agreed, upon the foresaid conditions, for eight acres each of the Flow-moss. Thus 1200 acres are now disposed of to 115 tenants. But when these 35 tenants shall each have cleared their acre, then, according to agreement, 35 additional tenants will speedily be acquired; and the moss will then contain in all 150 families.

To the leases already granted to the tenants in the High Moss, it is now determined to add a further period of 19 years (making in all 57 years), during which they are to pay one guinea per acre; a rent not greater than the land is worth even at present, but greatly below its probable value at that distant period. This, it is hoped, will prove to the tenants a sufficient incitement to continue their operations till their possessions are completely cleared from moss.

Having now gone through, in detail, the whole progress of the colony since its first settlement in the year 1767, it still remains to take a general view of the effects produced by that establishment.

For several years, at first, the water was used chiefly to carry off moss, in the forming of new roads, and preparing reservoirs; which considerably retarded the principal object of gaining land. Nevertheless there have been cleared full 300 acres of excellent land, producing wheat, barley, oats, and clover, yielding from six to twelve bolls after one.

From the nature of the undertaking, there is good reason to suppose that the operations will yearly advance with greater rapidity; especially as the greater number of the settlers have only of late begun to operate. Many, besides maintaining their families otherwise by occasional employments, have in the High Moss cleared in a year one rood of land; some have cleared two, some three roods, and in the Low Moss an acre.

It was a remark often made, even by persons of some observation, that by collecting together such a number of people, Kincardine would be over-stocked; and the consequence would be their becoming a burthen on the parish: for as the bulk of them were labourers not bred to any trade, and possessed of little stock, it was foreseen that, for some time, they could not afford to confine themselves solely to the moss, from which the return must be slow; but behoved, for immediate subsistence, to work for daily hire. Happily these predictions have proved entirely groundless; for such is the growing demand for hands in this country, that not only do the whole of these people find employment whenever they choose to look for it, but their wages have been yearly increasing from the time of their first establishment. In short, they have proved to the corner where they are set down a most useful nursery of labourers; and those very farmers who, at first, so strongly opposed their settlement, now fly to them as a sure resource for every purpose of agriculture. Still they consider the moss-operations as their principal business; none pay them so well; and when they do leave it to earn a little money, they return with cheerfulness to their proper employment. Many of them already raise from 10 to 60 bolls of grain, and have no occasion to go off to other work; which will soon be the case with the whole. Their original stock, indeed, did not often exceed L.25, and some had not even L.10; but what was wanting in stock is compensated by industry. Moss.

Of the whole inhabitants full nine-tenths are Highlanders, from the neighbouring parishes of Callander, Balquhidder, &c.; a sober, frugal, and industrious people, who, inured to hardships in their own country, are peculiarly qualified to encounter so arduous an undertaking. From this circumstance, too, arises a very happy consequence; that wearing a different garb and speaking a different language from the people amongst whom they are settled, they consider themselves in a manner as one family transported to a foreign land. And hence upon all occasions of difficulty, they fly with alacrity to each others relief. Neither ought it to be forgotten, that, from their first settlement to the present day, not a single instance has occurred amongst them of theft, bad neighbourhood, or of any other misdemeanour, that required the interposition of the civil magistrate. Nor, however poor in circumstances, has any one of them ever stooped to solicit assistance from the funds of the parish appropriated to that purpose.

Though few of the tenants entered with a large stock, one only has been obliged to leave the moss from incapacity to proceed. Many indeed have spent their small stocks, and even run a little in debt: but in this case they have been permitted to sell their tacks upon the following conditions: *1st*, That the purchaser shall be a good man; *2d*, That the seller shall take another possession. By this manœuvre a new inhabitant is gained; while the old one, relieved from debt, and aided by past experience, recommences his operations with double spirit upon a new possession. The monied man, again, has at once a house and a piece of ground; the want of which, chiefly, startled new beginners.

Some have even made a kind of trade of selling; insomuch, that from the year 1774 to the present year 1792, no fewer than fifty sales have taken place, producing in all the sum of L.849 Sterling. This proved from time to time a most seasonable recruit to the colony, and gave new vigour and spirits to the whole.

The number of the settlers is productive of an excellent effect; that although some are generally absent, enough still remain to occupy the water constantly. In a favourable day there may be seen hundreds, men, women, and children, labouring with the utmost assiduity. The women declare they can make more by working at the moss than at their wheel; and such is the general attachment to that employment, that they have frequently been discovered working by moon-light.

Another happy consequence arising from their numbers is the great quantity of moss they consume for fuel. There are in all 115 families. Each family requires at an average 10 dargues (B) of peats yearly.

(B) A dargue (or darg) of peats, is the quantity that one man can cast and two can wheel in a day to the field where they are spread out to dry.

Moſs. Each darg uncovers a ſpace equal to 10 ſquare yards of clay: ſo that by caſting peats, the moſs tenants gain yearly about 6 roods of land.

The advantage, too, of providing their fuel with ſo little trouble, is very great. They require yearly 1150 dargs of peats; which, as each darg when dried and ſtacked is valued at five ſhillings, are worth 287l. 10s. Sterling; a ſum which otherwiſe muſt have been expended on the prime coſt and carriage of coals. Many of them caſt peats for ſale; and L. 100 worth are yearly diſpoſed of in the town of Stirling, the village of Down, &c.

Though moſs-work be laborious, it is at the ſame time amuſing. The operator moves the moſs five feet only at a medium; and the water, like carts in other caſes, carrying it off as faſt as it is thrown in, excites him to activity. Still he muſt ſubmit to be wet from morning to night. But habit reconciles him to this inconvenience; while his houſe and arable land fill his eye and cheer his mind. Nor is it found that the health of the inhabitants is in the ſmalleſt degree injured either by the nature of the work or the vicinity of the moſs.

The quantity of moſs that one man can move in a day is ſurpriſing; when he meets with no interruption, ſeldom leſs than 48 cubic yards, each weighing 90 ſtones. The weight, then, of moſs moved per day is no leſs than 4320 ſtones. A cubic yard is moved into the water, and of courſe carried into the river Forth for one farthing. It follows, that the expence of moving 48 cubic yards is one ſhilling. But the ſame quantity moved to the ſame diſtance by carts would coſt 24 ſhillings. Hence the advantage derived from the poſſibility of floating moſs in water, and the great importance of having water for that purpoſe.

The moſs, when contraſted with the rich lands ſurrounding, appeared, eſpecially before the improvements, a very dreary ſpot; one wide unvaried wild, totally unproductive, unfit even to furniſh ſuſtenance to any animal, except here and there a few wretched ſtraggling ſheep. Beſides, it entirely cut off all connection betwixt the farms on either ſide; amongſt which no intercourſe was practicable but by a circuit of ſeveral miles.

The ſcene is already greatly changed. The following are the numbers of the inhabitants now reſiding in the moſs; alſo of their cows and horſes, and of the acres gained by them from the moſs, together with their produce.

Men - - -	115
Women - -	113
Boys - - -	199
Girls -	193
Total	620
Number of cows, at leaſt, -	115
Ditto of horſes and carts, -	34
Ditto of acres cleared from moſs, -	300

The produce in bolls cannot be exactly aſcertained: but, conſidering the goodneſs of the ſoil, may be fairly ſtated at 8 bolls per acre, *inde* 2400 bolls.

As oats are the ſtaple commodity, the calculation ſhall be confined to that grain. According to the fiars of Stirlingſhire, crop 1790 (the laſt crop for which they have been ſtruck), carſe oats are valued at 14s. per boll. *Inde* 2400 bolls at 14s. is L. 1680. Moſs.

A track of ground ſo conſiderable, formerly a nuiſance to the country, thus converted into a fertile field, filled with inhabitants, comfortable and happy, cannot ſurely be ſurveyed with an eye of indifference by any perſon whoſe mind is at all ſuſceptible of feeling or of public ſpirit.

An excellent gravelled road 20 feet wide and a mile and a half long, is now carried quite acroſs the moſs. By this means, in the firſt place, a ſhort and eaſy intercourſe is eſtabliſhed between two conſiderable parts of the eſtate, formerly as little connected as if ſeparated by a lake or an arm of the ſea. Secondly, the inhabitants of the Moſs, to whom, hitherto, all paſſage with carts or horſes was impracticable for at leaſt one half of the year, have now obtained the eſſential advantage of being able, with eaſe, to tranſport all their different commodities at every ſeaſon of the year. This road was entirely formed by the hands of the moſs-tenants, and gravelled by their own carts and horſes: a work which, it will not be doubted, they performed with much alacrity; when it is conſidered that, to the proſpect of procuring a laſting and material benefit to themſelves, there was joined the additional inducement of receiving an immediate ſupply of money, the whole being done at the proprietor's expence.

The poſſeſſions are laid off in the manner beſt fitted for the operations; and are divided by lanes running in ſtraight lines parallel to each other. Parallel to theſe again the drains are carried; and this ſtraight direction greatly facilitates the progreſs of the water with its load of moſs. Upon the bank of moſs fronting the lanes, the operation of floating is begun; and twenty or thirty people are ſometimes ſeen heaving moſs into the ſame drain. That the water may be the more conveniently applied, the lanes include between them the breadth of two poſſeſſions only. The new houſes are erected upon each ſide of theſe lanes at the diſtance of 100 yards from each other.

Before the formation of lanes and roads, and while yet no ground was cleared, the firſt ſettlers were obliged to erect their houſes upon the ſurface of the moſs. Its ſoftneſs denied all acceſs to ſtones; which, at any rate, are at ſuch a diſtance as would render them too expenſive. Settlers, therefore, were obliged to conſtruct their houſes of other materials. Upon the Low Moſs there is found for this purpoſe great plenty of ſod or turf, which accordingly the tenants uſe for the walls of their houſes. For the rudeneſs of the fabric nature in ſome meaſure compenſates, by overſpreading the outſide with a luxuriant coating of heath and other mooriſh plants, which has a very pictureſque appearance.

But upon the High Moſs there is no ſod to be found. There the tenant muſt go differently to work. Having choſen a proper ſituation for his houſe, he firſt digs four trenches down to the clay, ſo as to ſeparate from the reſt of the moſs a ſolid maſs, containing an oblong, rectangular area, ſufficiently large for his intended houſe. This being done, he then ſcoops out the middle of the maſs, leaving on all ſides the thickneſs of three feet for walls; over which he throws a roof,

Mofs.

roof, fuch as that by which other cottages are commonly covered.

Upon the fofteft parts of the mofs, even thefe walls cannot be obtained. In fuch places the houfes are built with peat dug out of the mofs, and clofely compreffed together while in a humid ftate (c). It is neceffary even to lay upon the furface a platform of boards to prevent the walls from finking; which they have frequently done when that precaution was neglected. After all, to ftamp with the foot will fhake the whole fabric as well as the mofs for fifty yards around. This, at firft, ftartled the people a good deal; but cuftom foon rendered it familiar.

The colonifts have now made confiderable advancement in rearing better habitations for their comfort and convenience. Their huts of turf are but temporary lodgings. As foon as they have cleared a little ground, they build houfes of brick; when the proprietor a fecond time furnifhes them with timber gratis. It has alfo been found neceffary to relieve them entirely from the payment of the burdenfome tax upon bricks; a tax which furely was never intended to fall on fuch poor induftrious adventurers; and which, without this affiftance, would have proved a moft effectual bar to the employment of thefe materials.

There are now erected in the mofs 69 brick-houfes, fubftantially built with lime. The total expence amounted to 1033 l. Sterling. And it is a very comfortable circumftance, that the money expended upon thefe houfes is moftly kept in circulation among the inhabitants themfelves: for as a number of them have learned not only to manufacture but alfo to build bricks, and as others who have horfes and carts furnifh the carriage of lime and coals, they thus interchange fervices with each other.

With a view to excite the exertion of the colonifts, the following premiums have lately been offered: 1. To the perfon who fhall in the fpace of one year remove the greateft quantity of mofs down to the clay, a plough of the beft conftruction. 2. To the perfon who fhall remove the next greateft quantity, a pair of harrows of the beft kind. 3. For the next greateft quantity, a fpade of the beft kind, and 10lb. of red clover-feed. But as thefe premiums, if contefted for by the whole inhabitants, could reach but a very few of the number, they have therefore been divided into fix diftricts according to their fituation, and the above premiums have been offered to each diftrict.

The eftablifhment of this colony has no doubt been attended with a very confiderable fhare of expence and difficulty; for the undertaking was altogether new, and there were many prejudices againft it, which it was neceffary to overcome. At the fame time it was noble and interefting: it was to make a valuable addition to private property: it was to increafe the population of the country, and to give bread to a number of people; many of whom having been turned out of their farms and cottaries in the Highlands, might otherwife, by emigration, have been loft to their country; and that too at a time when, owing to the great enlargement of farms, depopulation prevails but too much even in the low countries. And it was to add to the arable lands of the kingdom, making many thoufand bolls of grain to grow where none ever grew before.

Mofs ‖ Motacilla.

Thefe confiderations have hitherto preponderated with the proprietors againft the various obftacles that prefent themfelves to the execution of fo extenfive an undertaking. Should their example tend in any degree to ftimulate others, who both in Scotland and in England poffefs much ground equally ufelefs to the country, to commence fimilar improvements, it would be a moft grateful confideration fuperadded to the pleafure already arifing from the progrefs of the infant colony.

Moss-Troopers, a rebellious fort of people in the north of England, that lived by robbery and rapine, not unlike the tories in Ireland, the bucaneers in Jamaica, or banditti of Italy. The counties of Northumberland and Cumberland were charged with an yearly fum, and a command of men, to be appointed by juftices of the peace, to apprehend and fupprefs them.

MOSTRA, in the Italian mufic, a mark at the end of a line or fpace, to fhow that the firft note of the next line is in that place: and if this note be accompanied with a fharp or flat, it is proper to place thefe characters along with the moftra.

MOSUL, or MOUSUL. See MOUSUL.

MOTACILLA, in ornithology, the WAGTAIL and WARBLER: A genus of birds of the order of pafferes; diftinguifhed by a ftraight weak bill of a fubulated figure, a tongue lacerated at the end, and very flender legs. Plate CCCXV.

1. The alba, or white wagtail, frequents the fides of ponds and fmall ftreams, and feeds on infects and worms. The head, back, and upper and lower fide of the neck, as far as the breaft, are black; in fome the chin is white, and the throat marked with a black crefcent: the breaft and belly are white; the quill-feathers are dufky; the coverts black, tipt and edged with white. The tail is very long, and always in motion. Mr Willoughby obferves, that this fpecies fhifts its quarters in the winter; moving from the north to the fouth of England during that feafon. In fpring and autumn it is a conftant attendant on the plough, for the fake of the worms thrown up by that inftrument. Thefe birds make their neft on the ground, compofed of dry grafs, fine fibres of roots, and mofs lined within with hair or feathers. The eggs are five in number, white, fpotted with brown; and for the moft part there is only one brood in a year.

2. The flava, or yellow wagtail, migrates in the north of England, but in Hampfhire continues the whole year. The male is a bird of great beauty: the breaft, belly, thighs, and vent-feathers, being of a moft vivid and lovely yellow: the throat is marked with fome large black fpots; above the eye is a bright yellow

(c) This does not apply to the *morafs*, upon the furface of which, it has already been obferved, it is impoffible to erect houfes in any fhape.

Motacilla. yellow line: beneath that, from the bill, crofs the eye, is another of a dufky hue; and beneath the eye is a third of the fame colour: the head and upper part of the body is of an olive-green, which brightens in the coverts of the tail; the quill-feathers are dufky; the coverts of the wings olive-coloured; but the lower rows dufky, tipt with yellowifh white; the two outmoft feathers of the tail half white; the others black, as in the former. The colours of the female are far more obfcure than thofe of the male: it wants alfo thofe black fpots on the throat. It makes its neft on the ground, in corn-fields: the outfide is compofed of decayed ftems of plants, and fmall fibrous roots; the infide is lined with hair: it lays five eggs.

3. The regulus, or gold-crefted wren, is a native of Europe, and of the correfpondent latitudes of Afia and America. It is the leaft of all the European birds, weighing only a fingle drachm. Its length is about four inches and an half; and the wings, when fpread out, meafure little more than fix inches. On the top of its head is a beautiful orange-coloured fpot called its *creft*, which it can hide at pleafure; the margins of the creft are yellow, and it ends in a pretty broad black line; the fides of the neck are of a beautiful yellowifh green; the eyes furrounded with a white circle; the neck and back of a dark green mixed with yellow; the breaft of a dirty white; the tail compofed of 12 feathers of a brown colour, an inch and an half long, but not forked. In America it affociates with the titmice, running up and down the bark of lofty oaks with them, and collecting its food in their company, as if they were all of one brood. It feeds on infects lodged in their winter dormitories in a torpid ftate. It is faid to fing very melodioufly.

4. The fialis, or blue-bird, is a native of moft parts of North America; and is about the bignefs of a fparrow. The eyes are large; the head and upper part of the body, tail, and wings, are of a bright blue, excepting that the ends of the feathers are brown. The throat and breaft are of a dirty red. The belly is white. It flies fwiftly, having very long wings; fo that the hawk generally purfues it in vain. It make its neft in holes of trees; refembles our robin-red breaft in its difpofition, and feeds only on infects.

5. The futoria, or taylor-bird, is a native of the Eaft-Indies. It is remarkable for the art with which it makes its neft, feemingly in order to fecure itfelf and its young in the moft perfect manner poffible againft all danger from voracious animals. It picks up a dead leaf, and fews it to the fide of a living one: its flender bill is the needle, and its thread is formed of fome fine fibres; the lining is compofed of feathers, goffamer, and down. The colour of the bird is light-yellow; its length three inches; and its weight only three-fixteenths of an ounce: fo that the materials of the neft and its own fize are not likely to draw down a habitation depending on fo flight a tenure.

6. The lucinia, or nightingale, exceeds in fize the hedge-fparrow. The bill is brown: the irides are hazel: the head and back pale tawny, dafhed with olive: the tail is of a deep tawny red; the under parts pale afh-colour, growing white towards the vent: the quills are cinereous brown, with the outer margins reddifh brown: the legs cinereous brown. The male and female are very fimilar. This bird, the moft famed of the feathered tribe for the variety, length, and fweetnefs of its notes, is migratory, and fuppofed to be an inhabitant of the Afiatic regions during fuch times as it is not to be found in Europe. It is met with in Siberia, Sweden, Germany, France, Italy, and Greece; but in all thofe places it is migratory, as in England. Haffelquift fpeaks of it as being in Paleftine; and Fryer afcertains its being found about Chulminor in Perfia: it is alfo fpoken of as a bird of China, Kamtfchatka, and Japan; at which laft place they are much efteemed, and fell dear; as they are alfo at Aleppo, where they are "in great abundance kept tame in houfes, and let out at a fmall rate to fuch as choofe it in the city, fo that no entertainment is made in the fpring without a concert of thefe birds." They are not found in America, though feveral of their birds improperly bear that name; and it is uncertain whether they are found in Africa. This bird vifits Britain in the beginning of April, and leaves us in Auguft; and during its continuance with us its range is confined to but a part of the ifland: it is not found in Scotland, Ireland, or North Wales, nor in any of the northern counties except Yorkfhire; and it does not migrate fo far to the weft as Devonfhire and Cornwall. They are folitary birds, never uniting into even fmall flocks; and in refpect to the nefts, it is very feldom that two are found near each other. The female builds in fome low bufh or quickfet hedge well covered with foliage, for fuch only this bird frequents; and lays four or five eggs of a greenifh brown. The neft is compofed of dry leaves on the outfide, mixed with grafs and fibres, lined with hair or down within, though not always alike. The female alone fits on and hatches the eggs, while the male not far off regales her with his delightful fong; but as foon as the young are hatched, he commonly leaves off finging, and joins with the female in the tafk of providing for and feeding them. After the young can provide for themfelves, the old female provides for a fecond brood, and the fong of the male recommences. They have been known to have three broods in a year, and in the hot countries even four. Thefe birds are often brought up from the neft for the fake of their fong. They are likewife caught at their firft coming over; and though old birds, yet by management can be made to bear confinement, and to fing equally with thofe brought up from the neft. None but the vileft epicure, as Mr Latham remarks, would think of eating thefe charming fongfters; yet we are told that their flefh is equal to that of the ortolan, and they are fatted in Gafcony for the table. Every fchool-boy muft have read of Heliogabalus eating of nightingales tongues; and that famed difh of the Roman tragedian Æfop, which was compofed of thofe of every finging or talking bird, and is faid to have coft about L. 6843 of our money.

7. The hippolais, or pettychaps, is fomewhat lefs than a linnet. The bill is fhort; the upper mandible black, the under bluifh: above and below the eye there is a yellowifh line: the head, neck, and upper parts are of a greenifh afh-colour; the quills and tail of a moufe-colour, with greenifh edges and black fhafts; and the under wing-coverts are yellow: the belly is of a filvery white; the breaft darker, and tinged with yellow: the legs are bluifh or lead-coloured. This fpecies is frequent in feveral parts of England, and makes a neft of

Motacilla. of an arched form, compofed of dry bents, mixed with a little mofs, and thickly lined with feathers: it is placed on the ground under a tuft of grafs or at the bottom of a bufh. The eggs are five in number, white, fprinkled all over with fmall red fpots, moft fo at the largeft end. In Dorfetfhire it is known by the name of *hay-bird.* In Yorkfhire is is called the *beam-bird,* from its neftling under beams in outbuildings.

8. The atricapilla, or blackcap, is fmaller than the pettichaps. The bill is brown: the top of the head is black; and the upper parts of the body are of a greenifh afh-colour: the fides of the head and under parts are grey, changing to very light grey, or almoft white, towards the vent: the quills and tail are cinereous brown, margined with the fame colour as the upper parts: legs are lead-coloured, and the claws black. This bird is pretty common in England, and elfewhere in Europe, as far as Italy; in all which places it is known to breed; coming in fpring, and retiring in September. In Italy it builds twice in the year; with us only once. The neft, which is generally placed in fome low bufh not far from the ground, is compofed of dried ftalks, mixed with a little wool and green mofs round the verge; the infide lined with the fibres of roots, thinly covered with black horfe-hair. The eggs are five in number; of a pale reddifh brown, mottled with a deeper colour, and fprinkled with a few dark fpots. The male and female fit by turns during incubation; and the young very early leap out of the neft, efpecially if any one approaches it, and forfake it for ever. The food is chiefly infects; but in defect of thefe they will eat the fruits of fpurge laurel, fervice, and ivy; and feems to be even fond of the laft, as they much frequent fuch trees as are overgrown with it. The fong is much efteemed, and in many things almoft equalling the nightingale itfelf; fcarcely deficient, except in the delightful variety of note of the laft named bird. Hence by many it has been named the *mock nightingale.*

9. The modularis, or hedge-fparrow, a well-known bird, has the back and wing coverts of a dufky hue edged with reddifh brown; rump of a greenifh brown; throat and breaft of a dull afh-colour; the belly a dirty white; and the legs of a dull flefh-colour. This bird frequents hedges in England; where it makes its neft of mofs and wool, lining it with hair; and lays four or five eggs of a fine pale blue. With us and the more northern regions it is feen at all feafons; but in France it is migratory, coming in October and departing northward in fpring. The note of this bird would be thought pleafant, did it not remind us of the approach of winter; beginning with the firft frofts, and continuing till a little time in fpring. Its often repeating the words *tit, tit, tit,* has occafioned its being called *titling;* a name it is known by in many places.

10. The phœnicurus, or red ftart, is fomewhat lefs than the red-breaft: the forehead is white; the crown of the head, hind part of the neck, and back, are deep blue grey; the cheeks and throat black; the breaft, rump, and fides, red; and the belly is white: the two middle tail-feathers are brown; the reft red; and the legs are black. The female has the top of the head and back cinereous grey; chin white. The fame parts are red in this fex as in the male, but not fo bright. The wings are brown in both fexes. This bird is migratory; coming hither in fpring, and departing in autumn about October. It is not fo fhy as many birds in refpect to itfelf; for it approaches habitations, and frequently makes its neft in fome hole of a wall where numbers of people pafs by frequently: yet it is content, if no one meddles with the neft; for the leaft derangement of the eggs, or almoft looking at them, efpecially if the female is difturbed thereby, caufes her to forfake the neft altogether. It frequently builds alfo in fome hole of a tree. The neft is compofed chiefly of mofs, lined with hair and feathers. The eggs are blue, and four or five in number. This bird frequently wags its tail; but does it fideways like a dog when he is pleafed, and not up and down like the wagtail. It is with difficulty that thefe birds are kept in a cage; nor will they fubmit to it by any means if caught old. Their fong has no great ftrength: yet it is agreeable enough; and they will, if taught young, imitate the note of other birds, and fing by night frequently as well as in the day-time.

11. The falicaria, or fedge-bird, is about the fize of the blackcap, but more flender. The head is brown, marked with dufky ftreaks: the cheeks are brown; with a white line over each eye, and above that a black one: the upper parts of the neck and back are of a reddifh brown; and the wing-coverts and quills dufky: the under parts are white; but the breaft and belly have a yellow tinge: the tail is brown, and much rounded; and the legs are dufky. This bird is common in England, and frequents places where reeds and fedges grow, among which it is faid to make the neft, though it has been known to do this on the loweft branches of trees. The neft is compofed of ftraw and dried fibres of plants, lined with hair; and the eggs five in number, of a dirty white, marbled with brown. It is obferved to imitate the note of the fwallow, fky-lark, houfe-fparrow, and other birds, in a pleafing but hurrying manner, and fings all night.

12. The ficedula, or epicurean warbler, is in length five inches: the upper parts are grey brown; the under parts greyifh white, with a tinge of brown on the breaft; and the legs are blackifh. This is a bird much efteemed on the continent for the delicate flavour of its flefh. Their chief food is infects; except in autumn, when they make great havock among the figs and grapes; whence it is fuppofed their great delicacy in fome meafure arifes. It is not found in England, but met with in moft of the intermediate parts between Sweden and Greece; where, however, it is only a fummer-inhabitant, probably retiring ftill more fouth at the approach of winter. In the ifle of Cyprus and Candy they abound greatly, infomuch as to be an article of commerce. They tranfport them in veffels filled with vinegar and fweet herbs: the ifle of Cyprus alone collects 1000 or 1200 of thefe pots every year.

13. The rubecula, or red-breaft, is univerfally known: the upper parts are of a greenifh afh-colour; the forehead, throat, neck, and breaft, a rufous orange; the belly and vent whitifh; the bill, legs, and fides of the body, dufky. It is a conftant inhabitant of thefe kingdoms, as well as the whole European continent from Sweden to Italy. It abounds in Burgundy and Lorraine, where numbers are taken for the table, and thought

Motacilla. thought excellent. It builds not far from the ground if in a bush; though sometimes it fixes on an out-house, or retired part of some old building. The nest is composed of dried leaves, mixed with hair and moss, and lined with feathers. The eggs are of a dusky white, marked with irregular reddish spots; and are from five to seven in number. The young, when full feathered, may be taken for a different bird, being spotted all over. The first rudiments of the red break forth on the breast about the end of August; but it is quite the end of September before they come to the full colour. Insects are their general food; but in defect of these they will eat many other things. No bird is so tame and familiar as this; closely attending the heels of the gardener when he is using his spade, for the sake of worms; and frequently in winter entering houses where windows are open, when they will pick up the crumbs from the table while the family is at dinner. Its familiarity has caused a petty name to be given it in several countries. The people about Bornholm call it *Tommi-liden*; in Norway, *Peter Ronsmad*; the Germans, *Thomas Gierdet*; and we, the *Robin Red-breast*.

14. The rubicola, or stone-chatter, is in length about four inches and three quarters. The male has the upper parts of the body mixed blackish and pale rufous: on each side the neck there is a transverse streak of white: the breast is of a reddish yellow; the belly paler: and the legs are black. The female has the colours much less vivid. This bird inhabits dry places, such as heaths and commons; living on insects of all kinds. It makes its nest early, at the foot of some low bush, or under a stone; and lays five or six eggs of a bluish green, sparingly marked with faint rufous spots. It is so very crafty as not to betray the place of the nest, never alighting but at some distance, and creeping on the ground to it by the greatest stealth. It is a restless bird, incessantly flying from bush to bush; and seems to have received its English name from its note, resembling the clicking of two stones together.

15. The rubetra, or whin-chat, is somewhat bigger than the stone-chatter. The upper parts are blackish, edged with rufous: from the bill arises a streak of white, which passes over the eye on each side, almost to the hind head: beneath this the cheeks are blackish; the chin is white; the rest of the under parts rufous white: on the wing, near the shoulder, is a transverse white mark, and another smaller near the bastard wing, on the outer edge: the legs are black. The female differs in being paler, and the spots on the wings and the white trace over the eye being far less conspicuous. This is not uncommon in Britain, and is seen along with the stone-chatter on the heaths during the summer months; where it breeds, making the nest much after the manner of that bird. It lays five dirty white eggs, dotted with black. This species is common also on the continent of Europe, in France, Italy, Germany, and the more temperate parts of Russia; but it is said to be less common than the stone-chatter there, as it is also in England. Its food is chiefly insects; and is said to be as good as the ortolan, when fat and in good condition.

16. The œnanthe, or wheat-ear, is in length five inches and a half. The top of the head, hind part of the neck, and back, are of a bluish grey; and over the eye a streak of white: the under parts of the body yellowish white, changing to pure white at the vent: the breast is tinged with red; and the legs are black. This bird is met with in most parts of Europe, even as far as Greenland; and specimens have also been received from the East Indies. It visits England annually in the middle of March, and leaves us in September. It chiefly frequents heaths. The nest is usually placed under shelter of some turf, clod, stone, or the like, always on the ground, and not unfrequently in some deserted rabbit-burrow. It is composed of dry grass or moss, mixed with wool, fur of the rabbit, &c. or lined with hair and feathers. The eggs are from five to eight in number, of a light blue, with a deeper blue circle at the large end. The young are hatched the middle of May. In some parts of England these birds are in vast plenty. About Eastbourn in Sussex they are taken in snares made of horse-hair placed beneath a long turf: Being very timid birds, the motion of a cloud or the appearance of an hawk will drive them for shelter into these traps, and so they are taken. The numbers annually ensnared in that district alone amount to about 1840 dozen, which usually sell at sixpence per dozen. Quantities of these are eaten on the spot by the neighbouring inhabitants; others are picked, and sent up to the London poulterers; and many are potted, being as much esteemed in England as the ortolan on the continent. Their food is insects only; though in rainy summers they feed much on earth-worms, whence they are fattest in such seasons.

17. The cyanea, or superb warbler, a most beautiful species, is five inches and a half long. The bill is black: the feathers of the head are long, and stand erect like a full crest; from the forehead to the crown they are of a bright blue; from thence to the nape, black like velvet: through the eyes from the bill there runs a line of black; and beneath the eye springs a tuft of the same blue feathers; beneath which, and on the chin, it is of a deep blue almost black, and feeling like velvet: on the ears is another patch of blue, and across the back part of the head a band of the same; the whole giving the head a greater appearance of bulk than is natural: the hind part of the neck, and upper parts of the body and tail, are of a deep blue black; the under, pure white: the wings are dusky; the shafts of the quills chesnut: the legs are dusky brown; the claws black. It inhabits Van Diemen's Land, the most southern part of New Holland. The female of this species, of which a figure is given in Phillip's Voyage to Botany Bay, is discovered to be entirely destitute of all the fine blue colours, both pale and dark, by which the male is adorned, except that there is a very narrow circle of azure round each eye, apparently on the skin only: all the upper feathers consist of shades of brown, and the whole throat and belly is pure white. Except from the shape and size, this bird would not be suspected at first sight to belong to the same species as the male: the epithet of *superb* applies very ill to the female.

18. The troglodytes, or wren, is a very small species, in length only three inches three quarters, though some have measured four inches. The bill is very slender, and of a dusky brown colour: the head, neck, and back, are of a reddish brown; and over each eye a

a pale reddiſh white ſtreak: the under parts, as far as the breaſt, are of this laſt colour; the reſt more inclined to brown, croſſed with brown lines: the legs are pale brown. It generally carries the tail erect. The neſt is of a curious conſtruction, in ſhape almoſt oval, and has only one ſmall entrance: it is chiefly compoſed of moſs, well lined with feathers. In this the female lays from 10 to 16 or even 18 eggs, which are almoſt white, with reddiſh markings at the large end. She builds twice in a year, in April and June. The neſt is frequently found in ſome corner of an outhouſe, ſtack of wood, hole in a wall, or ſuch like, if near habitations; but in the woods often in a buſh near the ground, in a ſtump of a tree, or on the ground itſelf. This minute bird is found throughout Europe; and in England it defies our ſevereſt winters. Its ſong is much eſteemed, being, though ſhort, a pleaſing warble, and much louder than could be expected from the ſize of the bird: it continues throughout the year.

Above 150 other ſpecies, beſides varieties, are enumerated by ornithologiſts.

MOTE, in law-books, ſignifies court or convention; as a ward-mote, burgh-mote, ſwain-mote, &c.

MOTE, was alſo uſed for a fortreſs or caſtle; as *mota de Windſor*, &c.

MOTE alſo denoted a ſtanding water to keep fiſh in; and ſometimes a large ditch encompaſſing a caſtle or dwelling-houſe.

Mote-Bell, or *Mot-Bell*, the bell ſo called, which was uſed by the Engliſh Saxons to call people together to the court. See FOLKMOTE.

MOTH, in zoology. See PHALÆNA.

MOTHE LE VAYER (Francis de la), counſellor of ſtate, and preceptor to the duke of Anjou only brother to Louis XIV. was born at Paris in the year 1588. He was well educated by a learned father, whoſe merits and employment rendered him of conſequence; and he became ſo eminently learned himſelf, and diſtinguiſhed by his writings, that he was conſidered as one of the beſt members of the French academy, into which he was admitted in the year 1639. He was loved and conſidered by the two cardinals Richelieu and Mazarine, who governed France ſucceſſively. Splendid titles and honourable poſts were beſtowed upon him. He was appointed preceptor to the duke of Anjou, as we have ſaid, and would have been preceptor alſo to the king his brother, if the queen had not taken a particular fancy not to have that place beſtowed on a married man: though Moreri in his Dictionary, and Peliſſon in his Hiſtory of the French Academy, both affirm that he was preceptor to his majeſty for the ſpace of one year. He was a man of a very regular conduct, and a true philoſopher in his manners; yet was ſuſpected of having no religion. As great a philoſopher as he was, however, he was extremely afflicted at the loſs of his only ſon, who died when about 35 years of age; and his grief diſordered him ſo much that in three months after he married again, although he was above 75 years old. Le Vayer lived a long time after his ſecond marriage, and died in the year 1672. His works, collected into a body by his ſon, were dedicated to cardinal Mazarine in 1653: but the beſt and completeſt collection of them was that of Paris 1669, dedicated to Louis XIV. and conſiſting of 15 volumes in 12mo.

"There is no ſmall advantage (ſays Bayle) to be made of reading this writer: and we have no French author that approaches nearer to Plutarch than he. We find beautiful thoughts and ſolid arguments interwoven and diſperſed through all he wrote; wit and learning go hand in hand. His treatiſe concerning the education of the dauphin, and that of pagan philoſophy, are the beſt which he hath written."

MOTHER, a term of relation, denoting a woman who hath born a child.

Mother of Pearl. See MYTILUS.

MOTION is now generally conſidered as incapable of definition, being a ſimple idea or notion received by the ſenſes. The ancients, however, thought differently. Some of them defined it to be a paſſage out of one *ſtate* into another; which conveys no idea to him who is ignorant of the nature of motion.— The peripatetic definition has been mentioned elſewhere, and ſhown to be wholly unintelligible, as well as their celebrated diviſion of motion into four claſſes, belonging to the three categories, *quality*, *quantity*, and *where*; (ſee METAPHYSICS, n° 188, 189, 190.) The Carteſians, too, among the moderns, pretend to define motion, by calling it a paſſage or removal of one part of matter, out of the neighbourhood of thoſe parts to which it is immediately contiguous, into the neighbourhood of others. Borelli defines motion to be the ſucceſſive paſſage of a body from place to place. Others ſay that it is the application of a body to different parts of infinite and immoveable ſpace; and a late writer * of uncommon acuteneſs has given as a definition of motion—*change of place.*

1 Motion.

2 Several definitions of.

* See *An Eſſay on the Powers and Mechaniſm of Nature*, by Robert Young.

We have elſewhere offered our opinion of every poſſible attempt to define motion; but as the author of the laſt quoted definition has endeavoured to obviate ſuch objections as ours, candour requires that he be heard for himſelf. "It is ſaid (he obſerves) by ſome, that change implies motion, and therefore cannot be a part of its definition, being the very thing defined. To this I anſwer, We are ſpeaking of the ſenſible idea of motion, as it appears to our ſight; now changes do appear to our view, and to all our ſenſes, which give us no idea of motion. Changes in heat or cold; in colour, flavour, ſmell, ſound, hardneſs, ſoftneſs, pain, pleaſure; in theſe, and many other ideas, changes do not produce ideas like that produced by a ball rolling or a ſtone falling. We may, perhaps, ultimately trace them to motion, but to inſenſible motions; to motions which ariſe only in reflection, and conſtitute no part of the actual idea of change. We can, therefore, conceive of change, without conceiving at the ſame time of motion.— Change is a generic idea, including many ſpecies; motion, as a ſenſible idea, is a ſpecies of that genus. Change is therefore a neceſſary part of the definition of motion; it marks the genus of the thing defined. Motion is a change; but as there are many ſpecies of change, which of thoſe ſpecies is motion? The anſwer is, It is a change of place. This marks the ſpecies; and diſtinguiſhes it from change of colour, of temperament, and figure."

This is the ableſt defence of an attempt to define motion that we have ever ſeen; and at firſt view the definition itſelf appears to be perfect. Ariſtotle, the prince of definers, "conſiders a definition ‡ as a ſpeech

‡ See Dr Reid's account of Ariſtotle's logic, in Lord Kames's *Sketches of Man.*

ſpeech declaring what a thing is. Every thing eſſential to the thing defined, and nothing more, muſt be contained in the definition. Now the eſſence of a thing conſiſts of theſe two parts: firſt, what is *common* to it with other things of the ſame kind; and ſecondly, what *diſtinguiſhes* it from other things of the ſame kind. The firſt is called the *genus* of the thing; the ſecond, its *ſpecific difference*. The definition, therefore, conſiſts of thoſe two parts."

3 Shown not to declare what the thing is; and therefore to be no definition.

In obedience to this rule, the definition under conſideration ſeems to conſiſt of the *genus*, ſignified by the word *change*; and of the *ſpecific difference*, denoted by the words *of place*. But does the ſpeech *change of place* really declare what motion is? We cannot admit that it does; as, in our apprehenſion, a *change of place* is the *effect* of motion, and not *motion itſelf*. Suppoſe a lover of dialectic undertaking to define the ſtroke by which he ſaw his neighbour wounded with a bludgeon; what ſhould we think of his art were he to call it a contuſion on the head? He might ſay that *contuſion* is a general term, as contuſions may be produced on the arms, on the legs, and on various parts of the body; and as there are many ſpecies of contuſion, if he were aſked which of thoſe ſpecies was the ſtroke to be defined, he might anſwer, "a contuſion on the head." Here would be apparently the *genus* and *ſpecific difference*; the former denoted by *contuſion*, and the latter by the words *on the head*. But would this be a definition of a ſtroke? No, ſurely: a contuſion on the head may be the *effect* of a ſtroke; but it can no more be the *ſtroke itſelf*, than a blow can be a bludgeon, or a fleſh-wound the point of a ſword. Equally evident it is, that a change of place cannot be motion; becauſe every body muſt have been actually moved before we can diſcern, or even conceive, a change of its place.

The *act of changing place* would perhaps come nearer to a definition of motion; but ſo far would it be from "a ſpeech declaring what motion is," that we are confident a man who had never by any of his ſenſes perceived a body in actual motion, would acquire no ideas whatever from the words "act of changing place." He might have experienced changes in heat, cold, ſmell, and ſound; but he could not poſſibly combine the ideas of ſuch changes with the ſignification of the word *place*, were he even capable of underſtanding that word, which to us appears to be more than doubtful. (See METAPHYSICS, nº 40, 41.)

4 The diſtinctions of motion into different kinds inſignificant.

The diſtinctions of motion into different kinds have been no leſs various, and no leſs inſignificant, than the ſeveral definitions of it. The moderns who reject the peripatetic diviſion of motion into four claſſes, yet conſider it themſelves as either *abſolute* or *relative*. Thus we are told, that "*abſolute motion* is the change of abſolute *place*, and that its celerity muſt be meaſured by the quantity of *abſolute ſpace* which the moving body runs through in a given time." "*Relative motion*, on the other hand, is a mutation of the *relative* or *vulgar place* of the moving body, and has its celerity eſtimated by the quantity of *relative ſpace* run through."

Now it is obvious, that this diſtinction conveys no ideas without a farther explanation of the terms by which it is expreſſed; but that explanation is impoſſible to be given. Thus, before we can underſtand what *abſolute motion* is, we muſt underſtand what is meant by *abſolute place*. But abſolute place is a contradiction; for all *place* is *relative*, and conſiſts in the poſitions of different bodies with regard to one another. Were a globe in the regions of empty ſpace to be put in motion by Almighty Power, and all the reſt of the corporeal world to be ſoon afterwards annihilated, the motion would undoubtedly continue unchanged; and yet, according to this diſtinction, it would be at firſt *relative*, and afterwards *abſolute*. That the beginning of ſuch a motion would be *perceptible*, and the remainder of it *imperceptible*, is readily granted; but on this account to conſider it as of two kinds, is as abſurd as to ſuppoſe the motion of the minute-hand of a clock to be affected by our looking at it.

5 The opinions of the Carteſians and of Newton reſpecting the ſource of motion.

Leaving therefore theſe unintelligible diſtinctions, we now come to conſider a queſtion ſtill of a very abſtruſe nature, but much agitated among philoſophers, viz. What is the original ſource of motion in the creation? Is it natural to matter? or are we to aſcribe it to the immediate and continual agency of ſome *immaterial* being? The former has been ſtrenuouſly argued by the Carteſians, and the latter by the Newtonians. The arguments of the former, founded upon the chimerical hypotheſis of vortices and the original conſtruction of matter, were evidently inconcluſive; and the hypotheſis of Sir Iſaac Newton, who aſſerted that it was naturally *incapable* of motion, appeared more probable. To account for the quantity of motion in the univerſe, therefore, it became neceſſary to have recourſe either to the Deity, or to ſome ſubordinate ſpiritual agent; and this became the more neceſſary, as the doctrine of an abſolute vacuum in the celeſtial ſpaces, that is, throughout the incomparably greateſt part of the creation, was one of the fundamental maxims of the ſyſtem. As it was abſolutely denied that matter exiſted in theſe ſpaces, and it was plain that the celeſtial bodies affected one another at immenſe diſtances, the powers of attraction and repulſion were naturally called in as the ſources of motion by their impulſe upon inert and ſluggiſh matter. Theſe being admitted, a ſpeculation enſued concerning their nature. *Spiritual*, it was confeſſed, they were; but whether they were to be accounted the immediate action of the divine Spirit himſelf, or that of ſome ſubordinate and inferior ſpirit, was a matter of no little diſpute. Sir Iſaac Newton, towards the latter part of his life, began to relax ſomewhat of the rigidity of his former doctrine; and allowed that a very ſubtile medium, which he called *æther*, might be the cauſe of attraction and repulſion, and thus of the whole phenomena of nature. Since his time the multitude of diſcoveries in electricity, the ſimilarity of that fluid to fire and light, with the vaſt influence it has on every part of the creation with which we are acquainted, have rendered it very probable that the æther mentioned by Sir Iſaac is no other than the element of fire, "the moſt ſubtile † and elaſtic of all bodies, which ſeems to pervade and expand itſelf throughout the whole univerſe. Electrical experiments ſhow that this mighty agent is everywhere preſent, ready to break forth into action if not reſtrained and governed with the greateſt wiſdom. Being always reſtleſs and in motion, it actuates and enlivens the whole viſible maſs; is equally fitted to produce and to deſtroy; diſtinguiſhes the various ſtages of nature, and keeps up the perpetual round of generations and corruptions, pregnant with forms which

6 A ſubtle æther the probable cauſe of attraction and repulſion.

† *Siris*, nº 153, &c.

it

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it conſtantly ſends forth and reſorbs. So quick in its motions, ſo ſubtile and penetrating in its nature, ſo extenſive in its effects, it ſeemeth no other than the vegetative ſoul or vital ſpirit of the world.

7 The opinions of the ancients on this ſubject.

"The animal ſpirit in man is the inſtrument both of ſenſe and motion. To ſuppoſe ſenſe in the corporeal world would be groſs and unwarranted; but locomotive faculties are evident in all its parts. The Pythagoreans, Platoniſts, and Stoics, held the world to be an animal; though ſome of them have choſen to conſider it as a vegetable. However, the phenomena do plainly ſhow, that there is a ſpirit that moves, and a mind or providence that preſides. This providence, Plutarch ſaith, was thought to be in regard to the world what the ſoul is in regard to man. The order and courſe of things, and the experiments we daily make, ſhow that there is a mind which governs and actuates this mundane ſyſtem as the proper and real agent and cauſe; and that the inferior inſtrumental cauſe is pure æther, fire, or the ſubſtance of light, which is applied and determined by an infinite mind in the macrocoſm or univerſe, with unlimited power, and according to ſtated rules, as it is in the microcoſm with limited power and ſkill by the human mind. We have no proof either from experiment or reaſon of any other agent or efficient cauſe than the mind or ſpirit. When, therefore, we ſpeak of corporeal agents, or corporeal cauſes, this is to be underſtood in a different, ſubordinate, and improper ſenſe; and ſuch an agent we know light or elementary fire to be."

8 Experiments proving that a ſubtle æther may be the immediate cauſe of the planetary motions, &c.

That this elementary fire, abſorbed and fixed in all bodies, *may* be the cauſe of the univerſal principle of gravity, is made ſufficiently evident by numberleſs experiments. Homberg having calcined in the focus of a burning-glaſs ſome regulus of antimony, found that it had gained one-tenth in weight, though the regulus, during the whole time of the operation, ſent up a thick ſmoke, and thereby loſt a conſiderable part of its own ſubſtance. It is vain to allege that any heterogeneous matter floating in the air, or that the air itſelf, may have been hurried into the maſs by the action of the fire, and that by this additional matter the weight was increaſed: for it is known experimentally, that if a quantity of metal be even hermetically ſecured within a veſſel of glaſs to keep off the air and all foreign matter, and the veſſel be placed for ſome time in a ſtrong fire, it will exhibit the ſame effect. "I have ſeen the operation performed (ſays Mr Jones†) on two ounces of pewter-filings, hermetically ſealed up in a Florence flaſk, which in two hours gained 55 grains, that is nearly one 17th. Had it remained longer in the fire, it might probably have gained ſomething more; as, in one of Mr Boyle's experiments, ſteel-filings were found to have gained a fourth.

† *Eſſay on the Firſt Principles of Natural Philoſophy.*

"Of accounting for theſe effects there are but two poſſible ways: 1. If the quantity of matter be the ſame, or, in the caſe of calcination, be ſomewhat leſs, after being expoſed to the action of the fire, while the gravity of the whole is become greater; then does it follow, that gravity is not according to the quantity of matter, and of courſe is not one of its properties. 2. If there be an increaſe of the maſs, it can be imputed to nothing but the matter of light or fire entangled in its paſſage through the ſubſtance, and ſo fixed in its pores, or combined with its ſolid parts, as to gravitate together with it. Yet it is certain, from the phenomenon of light darting from the ſun, that this elementary fire does not gravitate till it is fixed in metal, or ſome other ſolid ſubſtance.—Here then we have a fluid which gravitates, if it gravitate at all, in ſome caſes and not in others. So that which way ſoever the experiment be interpreted, we are forced to conclude that elementary or ſolar fire may be the cauſe of the law of gravitation."

That it is likewiſe in many caſes the cauſe of repulſion, is known to every one who has ſeen it fuſe metals, and convert water and mercury into elaſtic vapour. But there is a fact recorded by Mr Jones, which ſeems to evince that the ſame fluid, which as it iſſues from the ſun exhibits itſelf in the form of light and heat, is in other circumſtances converted into a very fine air, or cold æther, which ruſhes very forcibly towards the body of that luminary. "As a ſequel to what has been obſerved (ſays he) concerning the impregnation of ſolid ſubſtances with the particles of fire, give me leave to ſubjoin an experiment of M. de Stair. He tells us, that upon heating red lead in a glaſs, whence the air was exhauſted by the rays of the ſun collected in a burning-glaſs, the veſſel in which the ſaid red lead was contained burſt in pieces with a great noiſe. Now, as all exploſions in general muſt be aſcribed either to an admiſſion of the air into a rarefied ſpace, or to what is called the *generation* of it; and as air was not admitted upon this occaſion, it muſt have been generated from the calx within the veſſel; and certainly was ſo, becauſe Dr Hales has made it appear that this ſubſtance, like crude tartar and many others, will yield a conſiderable quantity of *air* in diſtillation. What went into the metal therefore as *fire*, came out of it again as *air;* which in a manner forces upon us concluſions of ineſtimable value in natural philoſophy, and ſuch as may carry us very far into the moſt ſublime part of it."

One of the concluſions which the ingenious author thinks thus forced upon us, is, that the motion of the planets round the ſun, as well as round their own axis, is to be attributed to the continual agency of this fluid, under its two forms of elementary fire and pure air. As fire and light, we know that it ruſhes with inconceivable rapidity from the body of the ſun, and penetrates every corporeal ſubſtance, exerting itſelf ſometimes with ſuch force as nothing with which we are acquainted is able to reſiſt. If it be indeed a fact, that this elementary fire, or principle of light and heat, afterwards cools, and becomes pure air, there cannot be a doubt, but that under ſuch a form it will return with great force, though ſurely in a ſomewhat different direction, towards the ſun, forming a vortex, in which the planets are included, and by which they muſt of courſe be carried round the centre. Mr Jones does not ſuppoſe that the air into which the principle of light and heat is converted, is of ſo groſs a nature as our atmoſphere. He rather conſiders it as cool æther, juſt as he repreſents light to be æther heated: but he maintains, that this æther, in its aerial form, though not fit for human reſpiration, is a better *pabulum* of fire than the air which we breathe.

This theory is exceedingly plauſible; and the author

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thor supports it by many experiments. He has not, indeed, convinced us that the solar light is converted or convertible into pure air; but he has, by just reasoning from undoubted facts, proved that the whole expanse of heaven, as far as comets wander, is filled not only with light, which is indeed obvious to the senses, but also with a fluid, which, whatever it may be called, supplies the place of air in feeding the fire of these ignited bodies.

9 The existence of such an æther, however, does not completely solve the phenomena.

That the motion of the heavenly bodies should result from the perpetual agency of such a medium, appears to us a much more rational hypothesis, than that which makes them act upon each other at immense distances through empty space. But the hypothesis is by no means so complete a solution of the phænomena as some of its fond admirers pretend to think it. This fluid, whether called æther, heat, light, or air, is still material; and the question returns upon him who imagines that it is sufficient to account for gravitation, repulsion, magnetism, and cohesion, &c. "What moves the fluid itself, or makes the parts of which it is composed cohere together?" However widely it may be extended, it is incapable of positive infinity; and therefore *may be* divided into parts separated from each other; so that it must be held together by a foreign force, as well as a ball of lead, or a piece of wax. As matter is not essentially active, the motion of this æther, under both its forms, must likewise be considered as an effect, for which we do not think that any propelling power in the body of the sun can be admitted as a sufficient cause. For how comes the sun to possess that power, and what makes the fluid return to the sun? We have no notion of power, in the proper sense of the word, but as intelligence and volition; and, by the pious and excellent author of the *Essay on the First Principles of Natural Philosophy*, we are certain that the sun was never supposed to be intelligent.

10 It is therefore by some supposed to be animated.

Bishop Berkeley, who admits of light or æther as the instrumental cause of all corporeal motion, gets rid of this difficulty, by supposing, with the ancients, that this powerful agent is animated. "According to the Pythagoreans and Platonics (says his Lordship‡), there is a life infused throughout all things; the πυρ νοερον, πυρ τεχνικον, an intellectual and artificial fire, an inward principle, animal spirit, or natural life, producing and forming within, as art doth without; regulating, moderating, and reconciling the various motions, qualities, and parts of this mundane system. By virtue of this life, the great masses are held together in their ordinary courses, as well as the minutest particles governed in their natural motions, according to the several laws of attraction, gravity, electricity, magnetism, and the rest. It is this gives instincts, teaches the spider her web, and the bee her honey. This it is that directs the roots of plants to draw forth juices from the earth, and the leaves and cortical vessels to separate and attract such particles of air and elementary fire as suit their respective natures."

‡ *Siris*, n° 277.

This life or animal spirit seems to be the same thing which Cudworth calls plastic nature, and which has been considered elsewhere. (See METAPHYSICS, n° 200, and *PLASTIC Nature*.) We shall therefore dismiss it at present, with just admitting the truth of the Bishop's position, "that if nature be supposed the life of the world, animated by one soul, compacted into one frame, and directed or governed in all its parts by one supreme and distinct intelligence, this system cannot be accused of atheism, though perhaps it may of mistake or impropriety."

11 A new theory of motion.

A theory of motion somewhat similar to that of Berkeley, though in several respects different from it, was not many years ago stated with great clearness, and supported with much ingenuity, in *An Essay on the Powers and Mechanism of Nature*, intended to improve, and more firmly establish, the grand superstructure of the Newtonian system. Mr Young, the author of the essay, admits, with most other philosophers of the present age, that body is composed of atoms which are impenetrable to each other, and may be denominated solid. These atoms, however, he does not consider as primary and simple elements, incapable of resolution into principles; but thinks that they are formed by certain motions of the parts of a substance immaterial and essentially active.

12 By supposing that a substance essentially active pervades the universe.

As this notion is uncommon, and the offspring of a vigorous mind, we shall consider it more attentively under the article *PLASTIC Nature*. It is mentioned at present as a necessary introduction to the author's theory of motion, of which he attributes both the origin and the continuance to the agency of this elementary substance pervading the most solid atoms of the densest bodies. Of every body and every atom he holds the constituent principles to be essentially active: but those principles act in such a manner as to counterbalance each other; so that the atom or body considered as a whole is inert, unless in so far as it resists the compression or separation of its parts. No body or atom can of itself begin to move, or continue in motion for a single instant: but being pervious to the active substance, and coalescing with it, that substance, when it enters any body, carries it along with it, till, meeting some other body in the way, either the whole of the active substance lodged in the former body passes into the obstacle, in which case the impelling body instantly ceases to move; or else part of that substance passes into the obstacle, and part remains in the impelling body; and in this case both bodies are moved with a velocity in proportion to the quantity of matter which each contains, combined with the quantity of active substance by which they are respectively penetrated.

13 Proofs of the existence of such a substance.

In order to pave the way for his proof of the existence of one uniform active substance, he observes, that "*change* being an essentially constituent part of motion, and change implying action, it follows that *all motion implies action, and depends on an active cause*. Every motion (he continues) has a beginning, a middle, and an end. The beginning is a change from rest to motion; the middle is a continuance in motion; the end is a change from motion to rest." He then proceeds to show, that the beginning of motion is by an action begun; the continuance of motion by an action continued; and the end of motion by a cessation of action.

"The first of these positions is admitted by every body. That the *continuance* of motion is by an action *continued*, will be proved, if it shall be shown that the continuance of a motion is nothing different from its beginning, in regard to any point of time assumed in the continued motion. Now the beginning of motion (he says) consists in the beginning of change of plac

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place. But if any given portions of time and of ſpace are aſſumed, a body beginning to move in the commencement of that time, and in the firſt portion of the ſpace aſſumed, then and there begins that particular motion: and whether before the body began to move in that ſpace it was moving in other ſpaces and times, has no relation to the motion in queſtion; for this being in a ſpace and time altogether diſtinct, is a diſtinct motion from any which might have preceded it immediately, as much as from a motion which preceded it a thouſand years before. It is therefore a new motion begun; and ſo it may be ſaid of every aſſumable point in the continued motion. The term *continued* ſerves only to connect any two diſtinct motions, the end of one with the beginning of the other; but does not deſtroy their diſtinctneſs."

He then proceeds to combat, which he does very ſucceſsfully, the arguments by which the more rigid Newtonians endeavour to prove that a body in motion will continue to be moved by its own *inertia*, till ſtopt by ſome oppoſite force. Having done this, he eſtabliſhes the contrary concluſion by the following ſyllogiſms:

"I. Whatever requires an active force to ſtop its motion, is diſpoſed to move.

Every body in motion requires an active force to ſtop its motion:

Therefore every body in motion is diſpoſed to move.

"II. Whatever is diſpoſed to motion is poſſeſſed of action.

But a body in motion is diſpoſed to continue in motion.

Therefore a body in motion is poſſeſſed of action.

Thus it appears, that the middle part of any motion is action equally with the beginning.

"The laſt part of motion is its *termination*. It is admitted that all motion is terminated by an action contrary to the direction of the motion. It is admitted, too, that the moving body *acts* at the time its motion is deſtroyed. Thus the *beginning* and the *end* of any uniform motion are confeſſed to be actions; but all the intermediate *continuation* which connects the beginning with the end is denied to be action. What can be more unaccountable than this denial? Is it not more conſonant to reaſon and analogy, to aſcribe to the whole continued motion one uninterrupted action? Such a concluſion true philoſophy, we think, requires us to make.

"To move or act, is an attribute which cannot be conceived to exiſt without a ſubſtance. The *action of a body in motion* is indeed the attribute of the body, and the body relatively to its own motion is truly a ſubſtance, having the attribute or quality of motion. But the body being a name ſignifying a combination of certain ideas, which ideas are found to ariſe from action (ſee PLASTIC *Nature*), that action which is productive of thoſe ideas whoſe combination we denominate body, is of the nature of an attribute. In other terms, body is to be conſidered as an attribute ſo long as it is conſidered as conſtituted of action.—To this attribute we muſt neceſſarily aſſign its ſubſtance. The actions which conſtitute body muſt be actions of ſomething, or there muſt be ſomething which acts. What then is this ACTIVE SOMETHING from whoſe agency we get the idea of body, or whoſe actions conſtitute body? Is it not ſufficient that it is ſomething active? A name might be ſurely given it, but a name would not render the idea more clear. Its deſcription may be found in every ſenſation; it is colour to the eye, flavour to the palate, odour to the noſe, ſound to the ear, and feeling to the touch; for all our ſenſations are but ſo many ways in which this ACTIVE SOMETHING is manifeſted to us. A ſubſtratum of ſolidity philoſophers have imagined to exiſt, and have in vain ſought to find. Our ACTIVE SUBSTANCE is the ſubſtratum ſo long ſought for, and with ſo little ſucceſs. We give it a quality by which it may be perceived; it ACTS. One modification of *action* produces MATTER, another generates MOTION. Theſe modifications of action are modes of the active ſubſtance, whoſe preſence is action: matter and motion conſtitute the whole of nature. THERE IS THEREFORE THROUGHOUT NATURE AN ACTIVE SUBSTANCE, THE CONSTITUENT ESSENCE OF MATTER, AND IMMEDIATE NATURAL AGENT IN ALL EFFECTS."

14
Which is unintelligent.

By an argument which we do not think very concluſive, our author determines this active ſubſtance to be unintelligent. "In our ſenſations individually, not diſcovering (ſays he) the traces, not ſeeing the characters of intelligence, but finding only action preſent and neceſſary, our inferences go no farther than our obſervations warrant us to do; and we conclude in all theſe things an action only, and that action unintelligent." Having given our opinion of real agency elſewhere (ſee METAPHYSICS, n° 118.), we ſhall not here ſtop to examine this reaſoning.—We may however aſk, Whether all our ſenſations individually be not excited for a *certain end?* If they be, according to our author's mode of arguing in another place, the exciting agent ſhould be an intelligent being. By this we are far from meaning to deny the reality of a ſecondary or inſtrumental cauſe of ſenſation which is deſtitute of intelligence. We are ſtrongly inclined to think that there is ſuch a cauſe, though our perſuaſion reſults not from this argument of our author's. In our opinion, he reaſons better when he ſays, "that a ſubordinate agent conſtructed as the matter of creation, inveſted with perpetual laws, and producing agreeably to thoſe laws all the forms of being, through the varieties of which inferior intelligences can, by progreſſive ſteps, arrive ultimately at the ſupreme contriver, is more agreeable to our ideas of dignity, and tends to impreſs us with more exalted ſentiments, than viewing the Deity directly in all the individual impreſſions we receive, divided in the infinity of particular events, and unawful, by his continual preſence in operations to our view inſignificant and mean."

15
And neither matter nor mind.

This active ſubſtance, or ſecondary cauſe, our author concludes to be neither matter nor mind. "Matter (ſays he) is a being, as a whole quieſcent and inactive, but conſtituted of active parts, which reſiſt ſeparation, or cohere, giving what is uſually denominated ſolidity to the maſs. Mind is a ſubſtance which thinks. A being which ſhould anſwer to neither of theſe definitions, would be neither matter nor mind; but an *immaterial*, and, if I may ſo ſay, an *immental* ſubſtance." Such is the active ſubſtance of Mr Young, which,

Motion.

which, conſidered as the cauſe of motion, ſeems not to differ greatly from the *plaſtic nature, hylarchical principle*, or *vis genitrix*, of others. The manner in which it operates is indeed much more minutely detailed by our author than by any other philoſopher, ancient or modern, with whoſe writings we have any acquaintance.

"Every thing (he ſays) muſt be in its own nature either diſpoſed to reſt or motion; conſequently the ACTIVE SUBSTANCE muſt be conſidered as a being naturally either quieſcent or motive. But it cannot be naturally quieſcent; for then it could not be active, becauſe activity, which is a tendency to motion, cannot originate in a tendency to reſt. Therefore the ACTIVE SUBSTANCE is by nature motive, that is, tending to motion. The ACTIVE SUBSTANCE is not ſolid, and does not reſiſt penetration. It is therefore incapable of impelling or of ſuſtaining impulſe. Whence it follows, that as it tends to move, and is incapable of having its motion impeded by impulſe, it muſt actually and continually move: in other words, MOTION IS ESSENTIAL TO THE ACTIVE SUBSTANCE.

16
The manner in which it is ſuppoſed to operate,

"In order that this ſubſtance may *act*, ſome other thing upon which it may produce a change is neceſſary; for whatever ſuffers an action, receives ſome change. The active ſubſtance, in acting on ſome other thing, muſt impart and unite itſelf thereto; for its *action* is communicating its *activity*. But it cannot communicate its activity without imparting its ſubſtance; becauſe it is the ſubſtance alone which poſſeſſes activity, and the quality cannot be ſeparated from the ſubſtance. THEREFORE THE ACTIVE SUBSTANCE ACTS BY UNITING ITSELF WITH THE SUBSTANCE ON WHICH IT ACTS. The union of this ſubſtance with bodies, is not to be conceived of as a junction of ſmall parts intimately blended together, and attached at their ſurfaces; but as an entire diffuſion and incorporation of one ſubſtance with another in perfect coaleſcence. As bodies are not naturally active, whenever they become ſo, as they always do in motion, it muſt be by the acceſſion of ſome part of the active ſubſtance. The active ſubſtance being imparted to a body, penetrates the moſt ſolid or reſiſting parts, and does not reſide in the pores without, and at the ſurfaces of the ſolid parts. For the activity is imparted to the body itſelf; and not to its pores, which are no parts of the body: therefore, if the active ſubſtance remained within the pores, the cauſe would not be preſent with its effect; but the cauſe would be in one place and the effect in another, which is impoſſible.

Bodies by their impulſe on others loſe their activity in proportion to the impulſe. This is matter of obſervation. Bodies which ſuffer impulſe acquire activity in proportion to the impulſe. This alſo is matter of obſervation. In impulſe, therefore, the active ſubſtance paſſes out of the impelling body into the body impelled. For ſince bodies in motion are active, and activity conſiſts in the preſence of the active ſubſtance, and by impulſe bodies loſe their activity, therefore they loſe their active ſubſtance, and the loſs is proportional to the impulſe. Bodies impelled acquire activity; therefore acquire active ſubſtance, and the acquiſition is proportioned to the impulſe. But the active ſubſtance loſt by the impelling body ought to be concluded to be that found in the other; becauſe there is no other receptacle than the impelled body to which the ſubſtance parted from can be traced, nor any other ſource than the active body whence that which is found can be derived. Therefore, in impulſe, the active ſubſtance ought to be concluded to paſs from the impelling body to the body impelled. The flowing of ſuch a ſubſtance is a ſufficient cauſe of the communication of activity, and no other rational cauſe can be aſſigned.

"The continued motion of a body depends not upon its *inertia*, but upon the continuance of the active ſubſtance within the body. The motion of a body is produced by the motion of the active ſubſtance in union with the body. It being evident, that ſince the active ſubſtance itſelf does always move, whatever it is united to will be moved along with it, if no obſtacle prevent. In mere motion, the body moved is the patient, and the active ſubſtance the agent. In impulſe, the body in motion may be conſidered as an agent, as it is made active by its active ſubſtance.—While the active ſubſtance is flowing out of the active body into the obſtacle or impelled body, the active body will preſs or impel the obſtacle. For while the active ſubſtance is yet within the body, although flowing through it, it does not ceaſe to impart to the body its own nature, nor can the body ceaſe to be active, becauſe not yet deprived of the active ſubſtance. Therefore, during its paſſing out of the body, ſuch portion of the active ſubſtance as is yet within, is urging and diſpoſing the body to move, in like manner as if the active ſubſtance were continuing in the body; and the body being thus urged to move, but impeded from moving, preſſes or impels the obſtacle.

"We ſee here (ſays our author) an obvious explanation of impulſe; it conſiſts in the flowing of the motive ſubſtance from a ſource into a receptacle:" and he thinks, that although the exiſtence of ſuch a ſubſtance had not been eſtabliſhed on any previous grounds, the communication of motion by impulſe does alone afford a ſufficient proof of its reality. 17

produce impulſe,

He employs the agency of the ſame ſubſtance to account for many other apparent activities in bodies, ſuch as thoſe of *fire, electricity, attraction, repulſion, elaſticity*, &c. All the apparent origins of corporeal activity, ſerve (he ſays) to impart the active ſubſtance to bodies; "and where activity is without any *manifeſt* origin, the active ſubſtance is derived from an inviſible ſource."

Our limits will not permit us to attend him in his ſolution of all the apparent activities in bodies; but the orbicular motions of the planets have been accounted for in ſo many different ways by philoſophers ancient and modern, and each account has been ſo little ſatisfactory to him who can think, and wiſhes to trace effects from adequate cauſes, that we conſider it as our duty to furniſh our readers with the account of this phenomenon which is given by Mr Young. 18

and cauſe the motion of the heavenly bodies.

The queſtion which has been ſo long agitated, "Whence is the origin of motion?" our author conſiders as implying an abſurdity. "It ſuppoſes (ſays he) that reſt was the primitive ſtate of matter, and that motion was produced by a ſubſequent act. But this ſuppoſition muſt ever be rejected, as it is giving precedency to the inferior, and inverting the order of nature." The ſubſtance which he holds to be the

baſis

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basis of matter is essentially active; and its action is motion. This motion, however, in the original element, was *power* without direction, agency without order, activity to no end. To this power it was necessary that a LAW should be superadded; that its agency should be guided to some regular purpose, and its motion conspire to the production of some uniform effects." Our author shows, or endeavours to show, by a process of reasoning which shall be examined elsewhere, that the primary atoms of matter are produced by the circular motion of the parts of this substance round a centre; and that a similar motion of a number of these atoms round another centre common to them all, produces what in common language is called a *solid body*; a cannon-ball, for instance, the terrestrial globe, and the body of the sun, &c. In a word, he labours to prove, and with no small success, that a principle of union is implied in the revolving or circulating movements of the active substance.

"But we may also assume (he says) *à priori*, that a principle of union is a general law of nature; because we see in fact all the component parts of the universe are united systems, which successively combine into larger unions, and ultimately form *one* whole." Let us then suppose the sun with all his planets, primary and secondary, to be already formed for the purpose of making one system, and the orbits of all of them, as well as these great bodies themselves, to be pervaded by the active substance, which necessarily exists in a state of motion, and is the cause of the motion of every thing corporeal. "If to this motion a principle of union be added, the effect of such a principle would be a determination of all the parts of the active substance, and of course all the bodies to which it is united, towards a common centre, which would be at rest, and void of any tendency in any direction. But this determination of all the parts of the system towards a common centre, tends to the destruction both of the motion of the active substance and of the system; for should all the parts continually approximate from a circumference towards a centre, the sun and planets would at last meet, and form one solid and quiescent mass. But to preserve existence, and consequently motion, is the first law of the active substance, as of all being; and it cannot be doubted, that to preserve distinct the several parts of the solar system, is the first law given to the substance actuating that system. The union of the system is a subsequent law.

"When the *direct* tendency of any inferior law is obviated by a higher law, the inferior law will operate *indirectly* in the manner the nearest to its direct tendency that the superior law will permit. If a body in motion be obliquely obstructed, it will move on in a direction oblique to its first motion. Now the law of union, which pervades the solar system, being continually obstructed by the law of self-preservation, the motion of the active substance and of the bodies to which it is united can be no other than a revolving motion *about* the common centre of approach, *towards* which all the parts have a determination. But when this revolution has actually taken place, it gives birth to a new tendency, which supersedes the operation of the law of self-preservation. It has been shown, that the motion essential to the active substance, required to be governed by some law to give being to an orderly state of things. Now, there are motions simple and motions complex; the more simple is in all things first in order, and out of the more simple the more complex arises in order posterior. The most simple motion is rectilineal; therefore a rectilineal motion is to be considered as that which is the original and natural state of things, and consequently that to which *all things tend*. It will follow from hence, that when any portion of active substance in which the *law of union* operates, has in the manner above explained been compelled to assume a revolving motion, that is, a motion in some curve; a tendency to a rectilineal motion will continually exist in every part of the revolving portion, and in every point of the curve which it describes during its revolution. And this rectilineal tendency will be a tendency to recede from the centre in every point of the revolving orbit, and to proceed in a tangent to the orbit at each point. These two tendencies, if not originally equal, must necessarily in all cases arrive at an equality. For the tendency towards the centre, called the *centripetal* tendency, that is, the *law of union*, operating first, if we suppose the motion approaches the centre, the tendency to recede from it, called the *centrifugal* tendency, will have its proportion to the centripetal continually increased as the orbit of revolution grows less, so as ultimately to equal the centripetal tendency, and restrain the motion from its central course, at which point it will no longer seek the centre but revolve round it."

As our author holds that every atom of matter is formed by the motion of parts of the active substance, and every body formed by the motion of atoms; so he maintains, not only that the sun, moon, earth, planets, and stars, are penetrated by the same substance, but that each is the centre of a vortex of that substance, and that of these vortices some are included within others. "The subtle revolving fluid, the centre of whose vortex the earth occupies, not only surrounds but pervades the earth, and other vortices their earths, to their centres; and the earth and planets are by its revolutions carried around on their own axes. The earth is an inactive mass, and all its component masses are severally as well as collectively inactive; but the earth and all its parts have various collective and separate movements, imparted from the fluid which surrounds, pervades, and constitutes it. Being immersed together with its proper surrounding sphere or vortex in the larger sphere or vortex of the sun, it is carried thereby in a larger orbit about the sun, at the same time that by the revolution of its proper sphere it rotates on its own axis."

19 Objections to this theory.

Such is the most complete view which our limits will permit us to give of Mr Young's theory of motion. To the philosopher who considers experiment as the only test of truth, and who in all his inquiries employs his hands more than his head, we are fully aware that it will appear in no better light than as "the baseless fabric of a vision." Even to the intellectual philosopher who is not frightened at the word *metaphysics*, we are afraid that such an active substance as the author contends for, will appear as inadequate to the production of the phenomena of gravitation and repulsion as the material æther of Mr Jones and his followers. A being void of intelligence, whether it be material or immaterial, quiescent or motive, cannot

Motion. be the subject of law, in the proper sense of the word. The laws of which Mr Young speaks as necessary to regulate the motions of the active substance, must be mere *forces*, applied by some extrinsic and superior power. And since "motion, as it is *essential* to the active substance, is power without direction, agency without order, activity to no end; since it is of such a nature, that from its unguided agitations there could result neither connection, order, nor harmony;" it follows that those extrinsic forces must be *perpetually* applied, because what is *essential* to any substance can never be destroyed or changed so long as the substance itself remains.

Forces producing order out of confusion, can be applied only by a being possessed of intelligence; and if the immediate and perpetual agency of an intelligent being be necessary to regulate the motions of the active substance, that substance itself may be thought superfluous, and its very existence be denied. *Entia non sunt multiplicanda absque necessitate*, is a rule of philosophising which every man of science acknowledges to be just. And it will hardly be denied, that the immediate and perpetual agency of an intelligent being, upon Mr Jones's ætherial fluid, or even upon the matter of solid bodies themselves, would be capable of producing every kind of motion without the instrumentality of a substance which is neither mind nor matter.

Such, we conceive, are the objections which our metaphysical readers may make to this theory. Part of their force, however, will perhaps be removed by the ingenious manner in which our author analyses matter into an immaterial principle. But so much of it remains, that the writer of this article is inclined to believe that no mechanical account can be given of the motions of the heavenly bodies, the growth of plants, and various other phenomena which are usually solved by attraction and repulsion. In the present age, philosophers in general are strangely averse from admitting on any occasion the agency of mind; yet as every effect must have a cause, it is surely not irrational to attribute such effects as mechanism cannot produce to the operation either of intelligence or instinct. To suppose the Deity the immediate agent in the great motions of the universe, has been deemed impious; and it must be confessed that very impious conclusions have been deduced from that principle. But there is surely no impiety in supposing, with the excellent bishop of Cloyne, that the fluid which is known to pervade the solar system, and to operate with resistless force, may be animated by a powerful mind, which acts instinctively for ends of which itself knows nothing. For the existence of such a mind, no other evidence, indeed, can be brought than what is afforded by a very ancient and very general tradition, and by the impossibility of accounting for the phenomena upon principles of mere mechanism. Perhaps some of our more pious readers may be inclined to think that the Supreme Being has committed the immediate government of the various planetary systems to powerful *intelligences*, or ANGELS, who, as his ministers, direct their motions with wisdom and foresight. Such an opinion is certainly not absurd in itself; and it seems to be countenanced by an ancient writer*, who, though not known by the name of a philosopher, knew as much of the matter as any founder of the most celebrated school.

20 Other theories more ancient and rational.

* Psal. 104.

To object to either of these hypotheses, as has been sometimes done, that it represents the government of the world as a perpetual miracle, betrays the grossest ignorance; for we might as well call the movements of the bodies of men and brutes, which are certainly produced by minds, miraculous. We do not affirm that either hypothesis is certainly true; but they are both as probable and as satisfactory as the hypothesis which attributes agency to attraction and repulsion, to a subtle æther, or to a substance which is neither mind nor matter. Were the immediate agency of intellect to be admitted, there would be no room for many of those disputes which have been agitated among philosophers, about the increase or diminution of motion in the universe; because an intelligent agent, which could begin motion as well as carry it on, might increase or diminish it as he should judge proper. If instinctive agency, or something similar to it, be adopted, there is the same room for investigation as upon the principles of mechanism; because instinct works blindly according to steady laws imposed by a superior mind, which may be discovered by observation of their effects. As we consider this as by much the most probable hypothesis of the two, we find ourselves involved in the following question: "If a certain quantity of motion was originally communicated to the matter of the universe, how comes it to pass that the original quantity still remains?" Considering the many opposite and contradictory motions which since the creation have taken place in the universe, and which have undoubtedly destroyed a great part of the original quantity, by what means has that quantity been restored?

21 The question, Whether the original quantity of motion in the world remains unimpaired? answered by

If this question can be solved by natural means, it must be upon the principles of Newton; for "in every case § where quantities and relations of quantities are required, it is the province of mathematics to supply the information sought;" and all philosophers agree that Sir Isaac's doctrine of the composition and resolution of motion, though in what respects the heavenly bodies it may have no physical reality, is so mathematically just, as to be the only principle from which the quantity of motion, or the force of powers, can in any case be computed. If we choose to answer the question, by saying that the motion lost is restored by the interposition of the Deity, then we might as well have had recourse to him at first, and say that he alone is the true principle of motion throughout the creation.

§ *Young's Essay on the Powers and Mechanism*, &c.

Before we are reduced to this dilemma, however, it is necessary, in the first place, to inquire whether there is or can be any real diminution of the quantity of motion throughout the universe? In this question the Cartesians take the negative side; and maintain, that the Creator at the beginning impressed a certain quantity of motion on bodies, and that under such laws as that no part of it should be lost, but the same portion of motion should be constantly preserved in matter: and hence they conclude, that if any moving body strike on any other body, the former loses no more of its motion than it communicates to the latter. Sir Isaac Newton takes the contrary side, and argues in the following manner: "From the various compositions of two motions, it is manifest there is not always

22 The Cartesians, and

23 By Newton.

Motion.

ways the ſame quantity of motion in the world; for if two balls, joined together by a ſlender wire, revolve with an uniform motion about their common centre of gravity, and at the ſame time that centre be carried uniformly in a right line drawn in the plane of their circular motion, the ſum of the motions of the two balls, as often as they are in a right line, drawn from their common centre of gravity, will be greater than the ſum of their motions when they are in a line perpendicular to that other. Whence it appears, that motion may be both generated and loſt. But, by reaſon of the tenacity of fluid bodies, and the friction of their parts, with the weakneſs of the elaſtic power in ſolid bodies, nature ſeems to incline much rather to the deſtruction than the production of motion; and in reality, motion becomes continually leſs and leſs.— For bodies which are either ſo perfectly hard or ſo ſoft as to have no elaſtic power, will not rebound from each other; their impenetrability will only ſtop their motion. And if two ſuch bodies equal to one another be carried with equal but oppoſite motions, ſo as to meet in a void ſpace, by the laws of motion they muſt ſtop in the very place of concourſe, loſe all their motion, and be at reſt for ever, unleſs they have an elaſtic power to give them a new motion. If they have elaſticity enough to make them rebound with one-fourth, one-half, or three-fourths, of the force they meet with, they will loſe three-fourths, one-half, or one-fourth, of their motion. And this is confirmed by experiments: for if two equal pendulums be let fall from equal heights, ſo as to ſtrike full upon each other; if thoſe pendulums be of lead or ſoft clay, they will loſe all, or almoſt all, their motion; and if they be of any elaſtic matter, they will only retain ſo much motion as they receive from their elaſtic power."

Motion, therefore, being thus, in the opinion of our celebrated author, *loſt*, or *abſolutely deſtroyed*, it is neceſſary to find ſome cauſe by which it may be renewed. Such renovation Sir Iſaac attributes to *active* principles; for inſtance, "the cauſe of gravity, whereby the planets and comets preſerve their motions in their orbits, and all bodies acquire a great degree of motion in falling; and the cauſe of fermentation, whereby the heart and blood of animals preſerve a perpetual warmth and motion, the inner parts of the earth are kept perpetually warmed; many bodies burn and ſhine, and the ſun himſelf burns and ſhines, and with his light warms and cheers all things."

Elaſticity is another cauſe of the renovation of motion mentioned by Sir Iſaac. "We find but little motion in the world (ſays he), except what plainly flows either from theſe active principles, or from the command of the willer."

24 power motion r loſt or troyed,

With regard to the *deſtruction* or poſitive *loſs* of motion, however, we muſt obſerve, that notwithſtanding the authority of Sir Iſaac Newton, it is altogether impoſſible that any ſuch thing can happen. All moving bodies which come under the cognizance of our ſenſes are merely paſſive, and acted upon by ſomething which we call *powers* or *fluids*, and which are to us totally inviſible. Motion, therefore, cannot be loſt without a deſtruction or diminution of one of theſe *powers*, which we have no reaſon to think can ever happen. When two pendulums ruſh againſt each other, the motion is the mere effect of the action of gravity; and that action, which in this caſe is the *power*, continues to be the very ſame whether the pendulum moves or moves not. Could motion, therefore, be exhauſted in this caſe, we muſt ſuppoſe, that by ſeparating two pendulums to the ſame diſtance from each other, and then letting them come together for a great number of times, they would at laſt meet with leſs force than before. But there is certainly not the leaſt foundation for this ſuppoſition; and no rational perſon will take it into his head, that ſuppoſing the whole human race had employed themſelves in nothing elſe from the creation to the preſent day, but ſeparating pendulums and letting them ſtop each other's motion, they would now come together with leſs force than they did at firſt. *Power*, therefore, which is the cauſe of motion, is abſolutely indeſtructible. Powers may indeed counteract one another, or they may be made to counteract themſelves; but the moment that the obſtacle is removed, they ſhow themſelves in their priſtine vigour, without the leaſt ſymptom of abatement or decay.

25 proved by Sir Iſaac Newton's doctrine of the compoſition and reſolution of motion. Plate CCCXIV.

Under the article Mechanics, it has been ſhown, that when motion is compounded of two powers acting obliquely upon one another, more motion is loſt than the two powers taken together could ſpare. Thus, if the two powers AB and AC move a body through the diagonal of the ſquare AD; ſuppoſing each of theſe powers to be $=5$, the diagonal through which they paſs will be 7 (A); but from an inſpection of the figure, it is manifeſt, that by the ſeparation of the two powers, a quantity of motion BC, equal to the length of the other diagonal, is loſt; for in as far as the two act oppoſite to each other, they muſt deſtroy motion. The quantity of motion produced therefore being 7, and the quantity loſt the ſame, the whole quantity originally exiſting in the two powers AB and BC ought to have been 14, when it is only 10. To make up for the deficiency, therefore, we muſt ſearch for the origin of the two powers AB and BC, and this we ſhall find in the lines A*a*, A*c*, and A*d*; each of which is $3\frac{1}{2}$, altogether making 14; whence deducting 7 the motion loſt, we have 7 remaining for the motion produced. Let us now find out the origins of theſe powers, and we ſhall find thoſe of A*a* in the lines A*e* and A*f*; the origins of A*c* in A*f* and A*g*. The ſources of A*d* we find in the lines A*g* and A*b*. Thus we have now eight ſources of the four powers which generated the two firſt ones; and thus we find that the power $AD=7$, requires two of 5 each $=10$ for its generation; theſe two require four of $3\frac{1}{2}$ each for their production; and theſe again require eight of 2.4; each for their production. Hence, in order to generate the two original powers AB and AC, we ſee that there is required at a very few ſteps no leſs than 20; and in like manner, to generate theſe eight powers, we muſt have recourſe to 16 others; ſo that the ultimate ſource of motion increaſes beyond all calculation

Whether, therefore, we reckon the ultimate ſource of motion to be ſpiritual or material, it is plain that it muſt be to our conceptions *infinite*; neither will the phe-

(A) It will be ſomething more than 7; but the fractional part is omitted, as being of no importance in the illuſtration of the fact before us.

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phenomena of nature allow us to give any other explanation than we have done: for no power whatever can lose more than its own quantity; and it seems absurd to think that the Deity would create the world in such a manner that it would ultimately become immoveable, and then have recourse to unknown principles to remedy the supposed defect. On the principle we have just now laid down, however, the matter becomes exceedingly plain and obvious. The Creator at first formed two opposite powers, the action of which is varied according to the circumstances of the bodies upon which they act; and these circumstances are again varied by the action of the powers themselves in innumerable ways upon one another, and the approach of one body to another, or their receding to a greater distance. Where these powers happen to oppose each other directly, the body on which they act is at rest; when they act obliquely, it moves in the diagonal; or if the force acting upon one side is by any means lessened, the body certainly must move towards that side, as is evident from the case of the atmosphere, the pressure of which, when removed from one side of a body, will make it move very violently towards that side; and if we could continually keep off the pressure in this manner, the motion would assuredly be *perpetual*. We must not imagine that motion is *destroyed* because it is *counteracted*; for it is impossible to destroy motion by any means but removing the cause; counteracting the effect is only a temporary obstacle, and must cease whenever the obstacle is removed. Nature, therefore, having in itself an *infinite* quantity of motion, produces greater or lesser motions, according to the various action of the moving powers upon different bodies or upon one another, without a possibility of the general stock being either augmented or diminished, unless one of the moving powers was to be withdrawn by the Creator; in which case, the other would destroy the whole system in an instant.

26
The nature of the moving powers unknown.

As to the nature of these great original powers, we must confess ourselves totally ignorant; nor do we perceive any data from which the nature of them can be investigated. The elements of light, air, &c. are the agents; but in what manner they act, or in what manner they received their action, can be known only to the Creator.

Perpetual Motion, in mechanics, a motion which is supplied and renewed from itself, without the intervention of any external cause; or it is an uninterrupted communication of the same degree of motion from one part of matter to another, in a circle or other curve returning into itself, so that the same momentum still returns undiminished upon the first mover.

The celebrated problem of a perpetual motion consists in the inventing a machine, which has the principle of its motion within itself. M. de la Hire has demonstrated the impossibility of any such machine, and finds that it amounts to this; *viz.* to find a body which is both heavier and lighter at the same time, or to find a body which is heavier than itself.

To find a perpetual motion, or to construct an engine, &c. which shall have such a motion, is a famous problem that has employed the mathematicians of 2000 years; though none perhaps have prosecuted it with attention and earnestness equal to those of the present age.

Infinite are the schemes, designs, plans, engines, wheels, &c. to which this longed-for perpetual motion has given birth: it were as endless as impertinent to give a detail of them all.

In effect, there seems but little in nature to countenance all this assiduity and expectation; among all the laws of matter and motion, we know of none yet which seems to furnish any principle or foundation for such an effect.

Animal Motion, that which is performed by animals at the command of the mind or will.

Though all the motions of animals, whether voluntary or involuntary, are performed by means of the muscles and nerves, yet neither these nor the subtile fluid which resides in them are to be accounted the ultimate sources of animal motion. They depend entirely upon the mind for those motions which are properly to be accounted *animal*. All the involuntary motions, such as those of the blood, the heart, muscles, organs subservient to respiration and digestion, &c. are to be classed with those of vegetables: for though no vegetables have them in such perfection as animals, there are yet traces of them to be found evidently among vegetables, and that so remarkably, that some have imagined the animal and vegetable kingdoms to approach each other so nearly that they could scarce be distinguished by a philosophic eye. See Muscle.

Though the motions of animals, however, depend on the action of the mind or of the will, external objects seem originally to have the command of the mind itself; for unless an animal perceive something, it will not be inclined to act. By means of the ideas once received, indeed, and retained in the memory, it acquires a self-moving power, independent of any object present at the time, which is not the case with vegetables; for however they may act from a present impulse, their motions never appear to be derived from any source which may not be accounted strictly mechanical.

According to some, motion is the cause of sensation itself; and indeed it seems very probable that the motions of that subtle fluid, called *light* or *electricity*, in our bodies always accompany our sensations; but whether these be the *cause*, or only the *medium*, of sense, cannot be discovered.

Though all animals are endowed with a power of voluntary motion, yet there is a very great variety in the degrees of that power; to determine which no certain rules can be assigned; neither can we, from the situation and manner of life of animals, derive any probable reason why the motion of one should differ so very much from that of another. This difference does not arise from their size, their ferocity, their timidity, nor any other property that we can imagine. The elephant, though the strongest land animal, is by no means the slowest in its motions; the horse is much swifter than the bull, though there is not much difference in their size; a gre-hound is much swifter than a cat, though the former be much larger, and though both live in the same manner, *viz.* by hunting. Among insects the same unaccountable diversity is observable. The louse and flea are both vermin, are both nearly of the same size, and both feed on the bodies of animals; yet there is no comparison between the swiftness of their motions: while the bug, which is much larger than either, seems

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to have a kind of medium ſwiftneſs between both.—This very remarkable circumſtance ſeems not even to depend on the range which animals are obliged to take in order to procure food for themſelves: the motion of a ſnail is ſlower than that of an earth-worm; while that of many caterpillars is much quicker than either; though we can ſcarce determine which of the three has the greateſt or the leaſt extenſive range for its food.

Of all animals the ſhell-fiſh move the ſloweſt, inſomuch that ſome have ſuppoſed them to be entirely deſtitute of loco-motive powers; and muſcles particularly are denied to have any faculty of this kind. Every one knows that theſe animals can open and ſhut their ſhells at pleaſure; and it cannot eſcape obſervation, that in every muſcle there is a fleſhy protuberance of a much redder colour than the reſt. This has been thought to be a tongue or proboſcis, by which the animal takes in its food; but is in reality the inſtrument of its motion from place to place. This protuberance is divided into two lobes, which perform the office of feet. When the river muſcle is inclined to remove from its ſtation, it opens its ſhell, thruſts out this protuberance, and digs a furrow in the ſand; and into this furrow, by the action of the ſame protuberance, the ſhell is made to fall in a vertical poſition. It is recovered out of this into the former horizontal one, by puſhing back the ſand with the ſame tentacula, lengthens the furrow, and thus the animal continues its journey by a continual turning topſy-turvy.—Marine muſcles perform their motions in the ſame manner, and by ſimilar inſtruments. In general they are firmly attached to rocks or ſmall ſtones by threads about two inches long, which are ſpun from a glutinous ſubſtance in the protuberances already mentioned; theſe are called, in Scotland, the *beards* of muſcles, and are thought to be the cauſe of the fatal diſorders which ſometimes attend the eating of muſcles. See MYTULUS.

Other animals which dwell in bivalved ſhells, perform their motions by a kind of leg or foot; which, however, they can alter into almoſt any figure they pleaſe. By means of this leg they can not only ſink into the mud, or riſe out of it at pleaſure, but can even leap from the place where they are; and this can be done by the limpit, which people are apt to imagine one of the moſt ſluggiſh animals in nature.—When this creature is about to make a ſpring, it ſets its ſhell on edge, as if to diminiſh friction; then, ſtretching out the leg as far as poſſible, it makes it embrace a portion of the ſhell, and by a ſudden movement, ſimilar to that of a ſpring let looſe, it ſtrikes the earth with its leg, and actually leaps to a conſiderable diſtance.

The ſpout, or razor-fiſh, is ſaid to be incapable of moving forward horizontally on the ſurface; but it digs a hole ſometimes two feet deep in the ſand, in which it can aſcend or deſcend at pleaſure. The leg, by which it performs all its movements, is fleſhy, cylindrical, and pretty long; and the animal can at pleaſure make it aſſume the form of a ball. When lying on the ſurface of the ſand, and about to ſink into it, the leg is extended from the inferior end of the ſhell, and makes the extremity of it take on the form of a ſhovel, ſharp on each ſide, and terminating in a point. With this inſtrument the animal makes a hole in the ſand; after which it advances the leg ſtill farther into it, makes it aſſume the form of a hook, and with this, as a fulcrum, it obliges the ſhell to deſcend into the hole. This operation is continued until the whole ſhell be covered; and when the animal wiſhes to regain the ſurface, it makes the extremity of the leg to aſſume the form of a ball, and makes an effort to extend it. The ball, however, prevents any farther deſcent, and the reaction of the muſcular effort raiſes up the whole ſhell, which operation is continued until it reaches the ſurface; and it is ſurpriſing with what facility theſe motions are accompliſhed by an animal ſeemingly ſo little qualified to move at all. Another particularity in this fiſh is, that though it lives among ſalt water, it abhors ſalt ſo much that when a little is thrown into its hole it inſtantly leaves it. But it is ſtill more remarkable, that if you once take hold of the ſpout fiſh, and then allow it to retire into its hole, it cannot then be driven out by ſalt; though unleſs it be taken hold of by the hand, the application of ſalt will make it come to the ſurface as often as you pleaſe. See SOLEN.

All other ſhell-fiſh, even thoſe apparently the moſt ſluggiſh and deſtitute of any apparatus for motion, are found to be furniſhed with ſuch inſtruments as enable them to perform all thoſe movements for which they have any occaſion. Thus the ſcallop, a well-known animal inhabiting a bivalved ſhell, can both ſwim upon the ſurface of water and move upon land. When it happens to be deſerted by the tide, it opens its ſhell to the full extent, and ſhutting it again with a ſudden jerk, the reaction of the ground gives ſuch an impulſe to the whole, that it ſometimes ſprings five or ſix inches from the ground; and by a continued repetition of this action, it gradually tumbles forward until it regains the water. Its method of ſailing is ſtill more curious. Having attained the ſurface of the water by means unknown to us, it opens the ſhell, and puts one half above water, the other with the body of the animal in it remaining below. Great numbers of them are thus frequently ſeen ſailing in company with their ſhells ſticking up above water when the weather is fine, and the wind acting upon them as ſails; but on the leaſt alarm they inſtantly ſhut their ſhells, and all ſink to the bottom together. See PECTEN.

The oyſter has generally been ſuppoſed one of the moſt ſluggiſh animals in nature, and totally incapable of voluntary motion; but from the reſearches of the Abbé Dicquemarre, this opinion ſeems to be erroneous. The oyſter, like many other bivalved ſhell-fiſh, has a power of ſquirting water out from its body; and this property may eaſily be obſerved by putting ſome of them into a plate with as much ſea-water as will cover them. The water is ejected with ſo much force, as not only to repel the approach of ordinary enemies, but to move the whole animal backwards or ſideways, in a direction contrary to that in which the water was ejected. It has been alſo ſuppoſed, that oyſters are deſtitute of ſenſation; but M. Dicquemarre has ſhown, that they not only poſſeſs ſenſation, but that they are capable of deriving knowledge from experience. When removed from ſuch places as are entirely covered with the ſea, when deſtitute of experience, they open their ſhells and die in a few days; but if they happen to eſcape this danger, and the water covers them again, they will not open their ſhells

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again, but keep them ſhut, as if warned by experience to avoid a danger ſimilar to what they formerly underwent. See OSTREA.

The motions of the ſea-urchin are perhaps more curious and complicated than thoſe of any other animal. It inhabits a beautiful multivalved ſhell, divided into triangular compartments, and covered with great numbers of prickles; from which laſt circumſtance it receives the name of *ſea-urchin* or *ſea hedge-hog*. The triangles are ſeparated from one another by regular belts, and perforated by a great number of holes, from every one of which iſſues a fleſhy horn ſimilar to that of a ſnail, and capable of moving in a ſimilar manner. The principal uſe of theſe horns ſeems to be to fix the animal to rocks or ſtones, though it likewiſe makes uſe of them in its progreſſive motion. By means of theſe horns and prickles, it is enabled to walk either on its back or its belly; but it moſt commonly makes uſe of thoſe which are near the mouth. Occaſionally it has a progreſſive motion by turing round like a wheel. Thus, ſays Mr Smellie ‡, the ſea-urchin furniſhes an example of an animal employing many thouſand limbs in its various movements. The reader may try to conceive the number of muſcles, fibres, and other apparatus which are requiſite to the progreſſive motion of this little animal.

‡ *Phil. of Nat. Hiſt.*

Thoſe animals called *ſea-nettles* or *meduſæ*, though extremely ſlow in their motions, are nevertheleſs evidently capable of moving at pleaſure from place to place. The variety of their figure is ſuch, that it is difficult to aſſign them any determinate figure whatever. In general, however, they reſemble a truncated cone, the baſe of which is applied to the rock to which they adhere. Their colours are various, whitiſh, brown, red, or greeniſh: the mouth is very large; and when opened appears ſurrounded with filaments reſembling the horns of ſnails, which being diſpoſed in three rows around it, give the animal the appearance of a flower*; and through every one of theſe the animal has the power of ſquirting the ſea-water. The ſtructure of theſe animals is extremely ſingular; they conſiſting all of one organ, *viz* a ſtomach. When ſearching for food, they extend their filaments, and quickly entangle any ſmall animals that come within their reach. The prey is inſtantly ſwallowed, and the mouth ſhut cloſe upon it like a purſe; in which ſtate it remains for many days before the nutritive parts are extracted. The animal, though ſcarcely an inch or an inch and a half in diameter, is neverthels ſo dilatable, that it can ſwallow large whelks and muſcles, the ſhells of which are thrown out by the mouth after the nutritive parts have been exhauſted. Sometimes the ſhell is too large to be voided this way; in which caſe the body of the animal ſplits, and the ſhell is voided through the opening, which in a ſhort time heals up again. The progreſſive motion of this creature is ſo ſlow, that it reſembles that of the hour-hand of a clock, and is performed by means of innumerable muſcles placed on the outſide of the body. All theſe are tubular, and filled with a fluid, which makes them project like prickles. On occaſion it can likewiſe looſen the baſe of the cone from the rock, and inverting its body, move by means of the filaments already mentioned, which ſurround the mouth; but even the motion performed in this manner is almoſt as ſlow as the other.

* See *Actinia*.

Some animals are capable of moving backwards, apparently with the ſame facility that they do forwards, and that by means of the ſame inſtruments which move them forward. The common houſe-fly exhibits an inſtance of this, and frequently employs this retrograde motion in its ordinary courſes; though we cannot know the reaſon of its employing ſuch an extraordinary method. Another remarkable inſtance is given by Mr Smellie in the *maſon-bee*. This is one of the ſolitary ſpecies, and has its name from the mode of conſtructing its neſt with mud or mortar. Externally this neſt has no regular appearance, but at firſt ſight is taken for a quantity of dirt adhering to the wall; though the internal part be furniſhed with cells in the ſame regular manner with the neſts of other inſects of the bee-kind. When this bee leaves its neſt, another frequently takes poſſeſſion of it; in which caſe a battle never fails to enſue on the return of the real proprietor. The diſpute is decided in the air; and each party endeavours to get above the other, as birds of prey are wont to do in order to give a downward blow. The undermoſt one, to avoid the ſtroke, inſtead of flying forward or laterally, always flies backward. The encounter is ſo violent, that when they ſtrike, both parties fall to the ground.

Vegetable MOTION. Though vegetables have not the power of moving from one place to another like animals, they are nevertheleſs capable of moving their different parts in ſuch a manner as would lead us to ſuſpect that they are actuated by a ſort of inſtinct. Hence many have been induced to ſuppoſe, that the animal and vegetable kingdoms are in a manner indiſtinguiſhable from one another; and that the higheſt degree of vegetable life can hardly be known from the loweſt degree of animal life. The eſſential and inſuperable diſtinction, however, between the two, is the faculty of ſenſation, and locomotion in conſequence of it. Were it not, indeed, for the manifeſtation of ſenſe by moving from one place to another, we ſhould not be able to tell whether vegetables were poſſeſſed of ſenſation or not; but whatever motions they may be poſſeſſed of, it is certain that no vegetable has the faculty of moving from one place to another. Some have endeavoured to diſtinguiſh the two kingdoms by the digeſtion of food; alleging that plants have no proper organs, ſuch as a ſtomach, &c. for taking in and digeſting their aliment. But to this it has been replied, that the whole body of a vegetable is a ſtomach, and abſorbs its food at every pore. This, however, ſeems not to be a ſufficient anſwer. All animals take in their food at intervals, and there is not a ſingle inſtance of one which eats perpetually. The food is alſo taken into the body of the animal, and application of the parts made by means of the *internal* organization of the viſcus; but in vegetables, their whole bodies are immerſed in their food, and abſorb it by the ſurface, as animal bodies will ſometimes abſorb liquids when put into them. The roots of a tree indeed will change their direction when they meet with a ſtone, and will turn from barren into fertile ground; but this is evidently mere mechaniſm, without any proof of will or ſenſation; for the nouriſhment of the root comes not from the ſtone, but from the earth around it: and the increaſe in ſize is not owing to any expanſion of the matter which the root already contains,

contains, but to the oppofition of new matter; whence the increafe of fize muft always take place in the direction from whence the nourifhment proceeds. On this principle alfo may we explain the reafon why the roots of a tree, after having arrived at the edge of a ditch, inftead of fhooting out into the air, will creep down the one fide, along the bottom, and up the other.

In their other movements the vegetables difcover nothing like fenfation or defign. They will, indeed, uniformly bend towards light, or towards water; but in the one cafe we muft attribute the phenomenon to the action of the elements of light and air upon them; and in the latter the property feems to be the fame with what in other cafes we call attraction. Thus, if a root be uncovered, and a wet fpunge placed near it in a direction different from that in which the root was proceeding, it will foon alter its pofition, and turn towards the fpunge; and thus we may vary the direction of the root as often as we pleafe. The efforts of a plant to turn from darknefs or fhade into funfhine, are very remarkable; as, in order to accomplifh this, not only the leaves will be inclined, but even the ftems and branches twifted. When a wet fpunge is held under the leaves of a tree, they bend down in order to touch it. If a veffel of water be put within fix inches of a growing cucumber, in lefs than 24 hours the latter will alter its direction; the branches will bend towards the water, and never alter their courfe until they come in contact with it. The moft remarkable inftance of this kind of motion, however, is, that when a pole is brought near a vine, the latter will turn towards it, and never ceafe extending its branches till it lays hold of the fupport.

The motions of the fenfitive plant, and others of the fame kind, have been confidered as very wonderful; but it is doubtful if any of them be really more fo than that of the vine juft mentioned. None of thefe fhow any kind of propenfity to move without an actual touch. A very flight one, indeed, makes the fenfitive plant contract, and the whole branch, together with the leaves, bend down towards the earth.—This is fo fimilar to fome phenomena of electricity, that very few will hefitate at afcribing both to the fame caufe. Even the motions of the hedyfarum gyrans, which at firft fight feem fo much more furprifing than thofe of the fenfitive plant, may be explained upon the fame principle. There is a fpecimen of this plant in the botanic garden of Edinburgh. It is a native of the Eaft Indies, and its motions are occafioned by the fun-beams. The leaves are the only moveable parts. They are fupported by long footftalks; and when the fun fhines upon them they move brifkly in every direction. Their moft ufual motion is upward and downward; but not unfrequently they turn almoft quite round, and then the foot-ftalks are evidently twifted. Thefe motions continue only while the light and heat of the fun continues, ceafing when at night, or when the weather becomes cloudy and cold. The American plant called *Dionæa mufcipula*, or *Venus's fly trap*, is another example of very wonderful mechanifm in vegetables, though even this does not argue any degree of fenfation in this plant more than in others. The leaves of the dionæa are jointed, and furnifhed with two rows of prickles. A number of fmall glands upon the furface fecrete a fweet juice, which entices flies to come and fettle upon it; but the moment thefe infects touch the fatal fpot, the leaves fold up, and fqueeze them to death between the prickles. The leaves fold up in the fame manner when the plant is touched with a ftraw or pin.

The folding up of the leaves of certain plants in the abfence of the fun's light, called their *fleep*, affords another very curious inftance of vegetable motion.—Almoft all vegetables, indeed, undergo fuch a remarkable change in the night, that it is difficult to know exactly how many kinds do really fleep. They fold up their leaves in many different ways; but all agree in difpofing of them in fuch a manner as to afford the beft protection to the young ftems, flower-buds, or fruit. The leaves of the tamarind-tree contract round the young fruit, in order to protect it from nocturnal cold; and thofe of fenna, glycina, and many other papilionaceous plants, difpofe of their leaves in the fame manner. The leaves of the chickweed, afclepias, atriplex, &c. are difpofed in oppofite pairs. In the night-time they rife perpendicularly, and join fo clofe at the top that the flowers are concealed by them. In like manner do the leaves protect the flowers of the fida, or althæa theophrafti, the aycnia, and œnothira, the folanum, and the Egyptian vetch. All thefe are erected during the night; but thofe of the white lupine, in time of fleep, hang down.

The flowers of plants alfo have motions peculiar to themfelves. Many of them during the night are inclofed in their calyxes. Some, particularly thofe of the German fpurge, geranium ftriatum, and common Whitlow-grafs, when afleep bend towards the earth; by which means the noxious effects of rain or dew are prevented. All thefe motions have been commonly afcribed to the fun's rays; and Mr Smellie informs us, that in fome of the examples above-mentioned the effects were evidently to be afcribed to heat: but plants kept in an hot-houfe, where the temperature of the day and night are alike, contract their leaves, and fleep in the fame manner as if they were expofed to the open air; "whence it appears (fays he), that the fleep of plants is owing rather to a peculiar law, than to a quicker or flower motion of the juices." He fufpects, therefore, that as the fleep of plants is not owing to the mere abfence of heat, it may be occafioned by the want of light; and to afcertain this he propofes an experiment of throwing upon them a ftrong artificial light. "If, notwithftanding this light (fays he), the plants are not roufed, but continue to fleep as ufual, then it may be prefumed that their organs, like thofe of animals, are not only irritable, but require the reparation of fome invigorating influence which they have loft while awake, by the agitations of the air and of the fun's rays, by the act of growing, or by fome other latent caufe." On this, however, we muft remark, that the throwing of artificial light upon plants cannot be attended with the fame confequences as that of the light of the fun, unlefs the former were as ftrong as the latter, which is impoffible; and even granting that we could procure an artificial light as ftrong as that of the fun, a difference might be occafioned by the different directions of the rays, thofe of the fun being very nearly parallel, while the rays of all artificial light diverge very greatly. If, therefore,

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we are to make an experiment of this kind, the rays ſhould be rendered parallel by means of a burning mirror. Here again we would be involved in a difficulty: for the rays of the ſun proceed all in one direction; but as of neceſſity we muſt employ different mirrors in our experiment, the light muſt fall upon the plant in different directions, ſo that we could not reaſonably expect the ſame reſult as when the plants are directly expoſed to the rays of the ſun.

The motion of plants, not being deducible from ſenſation, as in animals, muſt be aſcribed to that property called *irritability;* and this property is poſſeſſed *inſenſibly* by the parts of animals in a greater degree than even by the moſt irritable vegetable. The muſcular fibres will contract on the application of any ſtimulating ſubſtance, even after they are detached from the body to which they belonged. The heart of a frog will continue to beat when pricked with a pin for ſeveral hours after it is taken out of the body. The heart of a viper, or of a turtle, beats diſtinctly from 20 to 30 hours after the death of theſe animals. When the inteſtines of a dog, or any other quadruped, are ſuddenly cut into different portions, all of them crawl about like worms, and contract upon the ſlighteſt touch. The heart, inteſtines, and diaphraghm, are the moſt irritable parts of animal bodies; and to diſcover whether this quality reſides in all plants, experiments ſhould be made chiefly on leaves, flowers, buds, and the tender fibres of the roots.

The motions of plants are univerſally aſcribed by our author to *irritability*, to which alſo we have aſcribed them under the article Animal. The term, however, requires an explanation; and to give this in an intelligible manner requires ſome attention. The moſt obvious compariſon is that of an electrified thread; which, on the approach of any unelectrified ſubſtance, ſhows a variety of motions, equally ſurpriſing with thoſe of the parts of plants or the muſcular fibres cut out of the body. Could we ſuppoſe that the electricity of a thread might be preſerved after it was cut off from the electrifying ſubſtance, it would ſhow as much irritability as even the muſcular fibres, or portions of the inteſtines of animals. We know, from the hiſtory of the torpedo, electrical eel, &c. that there are animals in which the electric fluid acts in ſuch a manner as to produce a much more powerful effect than that of giving motion to the leaves of plants. The readineſs, therefore, with which this fluid is thrown into agitations when any ſubſtance in which it acts is touched, is without doubt the irritability in queſtion; but we have from thence no more reaſon to aſcribe ſenſation to theſe irritable bodies, than to an electrified bottle when it diſcharges itſelf, or makes a cork-ball play around it.

In a paper read before the Academy of Sciences at Paris, by M. Brouſſonet, the author inclines to confound irritability and ſenſibility together. "The different parts of plants (ſays he) enjoy the faculty of motion; but the motions of a vegetable are very different in their nature from thoſe of an animal: the moſt ſenſible, thoſe that are produced with moſt rapidity in plants, are always influenced by ſome ſtimulating cauſe. Irritability, which is nothing but *ſenſibility* made manifeſt by motion, is a general law to which nature has ſubjected all living beings; and it is this that continually watches over their preſervation. Being more powerful in animals than in plants, it may be often confounded in theſe laſt with phenomena that depend on a quite different cauſe. In the vegetable it is only the organ which is expoſed to the action of the ſtimulating power that moves. Irritation in particular places never produces that prompt combination of ſenſations which we obſerve in animals; in conſequence of which certain parts are put in motion without being directly affected, and which otherwiſe might have been paſſive.

"The more perfect the organization in the different parts of animals is, the more apparent are the ſigns of irritability. The parts that come neareſt to thoſe of vegetables, and in which of conſequence the organization is moſt imperfect, are the leaſt irritable. The ſame law holds with regard to plants; but the reſult is oppoſite: the ſigns of irritability are moſt ſenſible in proportion to the analogy of the parts with thoſe of animals; and they are imperceptible in thoſe that are diſſimilar. This aſſertion is proved by what we obſerve in the organs deſtined in vegetables to perpetuate the ſpecies. Thoſe parts alone ſeem ſenſible to ſtimuli; the bark, leaves, ſtalks, and roots ſhowing no ſigns of irritability.

"The vital motions in plants are ſlow, and entirely determined by circumſtances, which are always repeated and equally diffuſed over all the parts. In animals, on the contrary, almoſt all the vital motions are very ſenſible; ſuch as the pulſations of the heart and arteries, the dilatation of the thorax, &c.: theſe being abſolutely neceſſary to the preſervation of the individual, are always reproduced in a ſimilar manner in thoſe of the ſame ſpecies, and in the ſame direction; and this takes place in like manner in plants. The twining plants, for inſtance, ſuch as the hop, follow conſtantly, as they twiſt themſelves round a pole, the direction of the ſouth towards the weſt. If vegetables are obſtructed in exerciſing theſe motions, they ſoon periſh: if, for example, we untwiſt a twining plant which had taken its direction round a branch from the right to the left, and place it in a contrary direction, it withers in a ſhort time; eſpecially if it has not vigour enough to regain its natural ſituation. We bring death in the ſame manner on an animal, if we interrupt any of its vital motions. The law by which plants are forced to move in a particular manner is very powerful: When two twining plants, one of which is weaker than the other, for example two plants of woodbine, happen to encounter, they twiſt round each other, the one directing itſelf to the right and the other to the left: this laſt is always the weakeſt; it is forced to take a direction contrary to that which it would have done if it had not met with the other: but if, by any accident, theſe two twigs of woodbine ſhould come afterwards to be ſeparated, they both reſume their natural direction, that is, from right to left.

"The motions eſſentially vital, which have in plants the greateſt affinity with thoſe of animals, are the courſe of the ſap, the paſſage of the air in the trachea, the different poſitions which the flowers of certain plants take at certain hours of the day, &c. But if we attend to the manner in which all theſe motions in plants are performed, we will find that they preſent a greater

number of modifications than the analogous motions that take place in animals. The temperature of the atmofphere, its agitation, light, &c. have great influence on the motions of plants, by accelerating or retarding the courfe of their fluids; and, as they cannot change their place, thefe variations produce in them changes more obvious and more uniform than in animals."

Our author now proceeds to inform us, that fome of the motions of plants are occafioned by the rarity of the juices in plants, and others by their abundance. Of the former kind are thofe by which the capfules of fome plants fuddenly burft with a fpring, and throw their feeds to fome diftance. Of the other kind are the action of the ftamina in the *parietaria*, the inflection of the peduncles of flowers, and of the piftilla. "Thofe motions (fays he) which are particularly obferved in the organs deftined to the reproduction of the individual, not appearing except in circumftances that render them abfolutely neceffary, feem in fome meafure to be the effect of a particular combination: they are, however, merely mechanical; for they are always produced in the fame way and in the fame circumftances. Thus the rofe of Jericho, and the dry fruit of feveral fpecies of *mefembryanthemum*, do not open but when their veffels are full of water.

"The fudden difengagement of fluids produces a kind of motion. To this caufe we muft attribute a great number of phenomena obfervable in the leaves of feveral plants, and which do not depend on irritability. The fmall glands in each leaf of the *dionæa* are no fooner punctured by an infect than it inftantly folds up and feizes the animal: the puncture feems to operate a difengagement of the fluid which kept the leaf expanded by filling its veffels. This explanation is the more probable, that in the early ftate of the vegetation of this plant, when the fmall glands are hardly evolved, and when probably the juices do not run in fufficient abundance, the leaves are folded up exactly as they appear when punctured by an infect at a more advanced period. We obferve a phenomenon fimilar to this in both fpecies of the *drofera* (fundew). The mechanifm here is very eafily obfervable: the leaves are at firft folded up; the juices are not yet propelled into the fine hairs with which they are covered; but after they are expanded, the prefence of the fluid is manifeft by a drop feen at the extremity of each hair: it is by abforbing this fluid that an infect empties the veffels of the leaf, which then folds up, and refumes its firft ftate: the promptitude of the action is proportioned to the number of hairs touched by the infect. This motion in fome degree refembles that which takes place in the limb of an animal kept in a ftate of flexion by a tumor in the joint; when the matter which obftructed the motion is difcharged, the limb inftantly refumes its former pofition. The phenomena that depend on the abundance of fluids are particularly evident in plants which grow in wet foils; the *drofera* and *dionæa* are of this kind: and it is known by the experiments of Meff. Du Fay and Du Hamel, that fenfitive plants are particularly fenfible when the fun is obfcured by clouds and the air warm and moift. The influence of external caufes fometimes fo modifies the vital motions in plants, that we would be tempted to afcribe them to volition, like thofe that depend entirely on that faculty in animals. If we fet a pole in the ground near a twining plant, it always lays hold of the pole for fupport, in whatever place we put it. The fame thing occurs in the tendrils of the vine; which always attach themfelves to the fupport prefented them, on whatever fide it may be placed, provided they can reach it: but thefe motions are entirely vital: the twining plants and the tendrils direct themfelves to every quarter, and confequently cannot fail of meeting with the bodies within their reach. Thefe motions are performed as long as the parts continue to grow; but when they ceafe to elongate, if they have not been able to reach any body on which they can fix, they bend back upon themfelves. This and other obfervations fhow how far the vital motions in plants may be modified by external caufes, and how effentially they differ from thofe that are the effect of volition in animals.

"Some plants appear endowed with no fort of motion: fome have leaves that can move in different directions: their motions are generally modified by different caufes; but none appear fo eminently poffeffed of this quality as the *hedyfarum gyrans* of Linnæus.— No part of this plant fhows any figns of irritability upon application of ftimuli: and the motion of its foliola ceafes when the leafets are agitated by the wind.— When the fun is warm, the little leaves of the hedyfarum are alfo immoveable; but when the weather is warm and moift, or when it rains, they move very freely. This motion feems indifpenfably neceffary to the plant: for it begins as foon as the firft leaves unfold, and continues even during the night; but in time it grows weaker. In our ftoves it is moft confiderable during the firft year; in the fecond, it is not very fenfible: in its native place all the leaves have a motion never obferved here. The moving leafets are moft agitated while the plants are in full flower, and the procefs of fructification goes on. The ofcillatory motion is fo natural to it, that it not only remains for three or four days in the leafets of a branch that has been cut off and put in water, but is even continued though the branch be expofed to the air. The leaves feem to perform the office of the heart in vegetables. When a plant is ftripped of its leaves, the progrefs of vegetation is arrefted; and fuch vegetables refemble thofe animals which have a periodical fleep, induced by a diminution of the action of the heart. Many plants hardly fhow any figns of motion; many feem alfo wholly cataleptic; which is rarely if ever found in animals. The footftalks of the flowers of dracocephalum, a Virginian plant, preferve themfelves in whatever pofition they are placed.

Mufcular Motion. See Muscle.

MOTIVE, is fometimes applied to that faculty of the human mind, by which we purfue good and avoid evil. Thus Hobbes diftinguifhes the faculties of the mind into two forts, the cognitive and motive.

MOTTE (Anthony Houdart de la), an ingenious Frenchman, greatly diftinguifhed by his writings in profe and verfe, and by his literary contefts with many eminent perfons, was born at Paris in 1672. He wrote with very different fuccefs, no man having been more praifed or more criticifed than he was: his literary paradoxes,

Motoualis. radoxes, his singular systems, in all branches of polite learning, and above all his judgment upon the ancients, which, like those of Perrault, were thought disrespectful and detracting, raised him up formidable adversaries. Racine, Boileau, Rousseau, and Madam Dacier, were among the number of those who made it their business to avenge antiquity on a man who, with more wit than genius or learning, assumed a kind of dictatorial authority in the province of belles lettres. He became blind in the latter years of his life, and died in 1731. He wrote a great deal in epic poetry, tragedy, comedy, lyric, pastoral, and fables; besides a vast variety of discourses, critical and academical, in prose. A complete edition of all his works was published in 11 vols 8vo, in 1754; though, as has been said of our Swift, his reputation had been better consulted by reducing them to three or four.

MOTOUALIS, a small nation of Syria, inhabiting to the east of the country of the DRUSES, in the valley which separates their mountains from those of Damascus; of which the following account is given by Mr Volney in his Travels, vol. ii. p. 84.

The characteristic distinction between them and the other inhabitants of Syria (says our author) is, that they, like the Persians, are of the sect of Ali, while all the Turks follow that of Omar or Moaouia. This distinction, occasioned by the schism which in the 36th year of the Hejira arose among the Arabs, respecting the successors of Mahomet, is the cause of an irreconcileable hatred between the two parties. The sectaries of Omar, who consider themselves as the only orthodox, assume the title of *Sonnites*, which has that signification, and term their adversaries *Shiites*, that is "sectaries of Ali." The word *Motouali* has the same meaning in the dialect of Syria. The followers of Ali, dissatisfied with this name, substitute that of *Adlia*, which means "assertors of justice," literally "Justiciarians;" a denomination which they have assumed in consequence of a doctrinal point they advance in opposition to the Sonnite faith. A small Arabic treatise, entitled Theological Fragments concerning the Sects and Religions of the World, has the following passage:

"Those sectaries who pretend that God acts only on principles of justice, conformable to human reason, are called *Adlia* or *Justiciarians*. God cannot (say they) command an impracticable worship, nor ordain impossible actions, nor enjoin men to perform what is beyond their ability; but wherever he requires obedience, will bestow the power to obey. He removes the cause of evil, he allows us to reason, and imposes only what is easy, not what is difficult; he makes no man responsible for the actions of another, nor punishes him for that in which he has no part; he imputes not as a crime what himself has created in man; nor does he require him to avoid what destiny has decreed. This would be injustice and tyranny, of which God is incapable from the perfection of his being." To this doctrine, which diametrically opposes the system of the Sonnites, the Motoualis add certain ceremonies which increase their mutual aversion. They curse Omar and Moaouia as rebels and usurpers; and celebrate Ali and Hosain as saints and martyrs. They begin their ablutions at the elbow, instead of the end of the finger, as is customary with the Turks; they think themselves defiled by the touch of strangers; and, contrary to the general practice of the East, neither eat nor drink out of a vessel which has been used by a person not of their sect, nor will they even sit with such at the same table. Motoualis.

These doctrines and customs, by separating the Motoualis from their neighbours, have rendered them a distinct society. It is said they have long existed as a nation in this country, though their name has never been mentioned by any European writer before the present century; it is not even to be found in the maps of Donville: La Roque, who left their country not a hundred years ago, gives them the name of *Amediens*. Be this as it may, in later times their wars, robberies, successes, and various changes of fortune, have rendered them of consequence in Syria. Till about the middle of this century, they only possessed Balbek their capital, and a few places in the valley, and Anti-Lebanon, which seems to have been their original country. At that period we find them under a like government with the Druzes, that is to say, under a number of Shaiks, with one principal chief of the family of Harfoush. After the year 1750 they established themselves among the heights of Bekaa, and got footing in Lebanon, where they obtained lands belonging to the Maronites, almost as far as Besharrai. They even incommoded them so much by their ravages, as to oblige the Emir Yousef to attack them with open force and expel them; but on the other side, they advanced along the river even to the neighbourhood of Sour, (Tyre). In this situation, Shaik Daher had the address, in 1760, to attach them to his party. The pachas of Saide and Damascus claimed tributes, which they had neglected paying, and complained of several robberies committed on their subjects by the Motoualis; they were desirous of chastising them; but this vengeance was neither certain nor easy. Daher interposed; and by becoming security for the tribute; and promising to prevent any depredations, acquired allies who were able, as it is said, to arm 10,000 horsemen, all resolute and formidable troops. Shortly after they took possession of Sour, and made this village their principal sea-port. In 1771 they were of great service to Ali Bey and Daher against the Ottomans. But Emir Yousef having in their absence armed the Druzes, ravaged their country. He was besieging the castle of Djezin, when the Motoualis, returning from Damascus, received intelligence of this invasion. At the relation of the barbarities committed by the Druzes, an advanced corps, of only 500 men, were so enraged, that they immediately rushed forward against the enemy, determined to perish in taking vengeance. But the surprise and confusion they occasioned, and the discord which reigned between the two factions of Mansour and Yousef so much favoured this desperate attack, that the whole army, consisting of 25,000 men, was completely overthrown.

In the following year, the affairs of Daher taking a favourable turn, the zeal of the Motoualis cooled towards him, and they finally abandoned him in the catastrophe in which he lost his life. But they have suffered for their imprudence under the administration of the pacha who succeeded him. Since the year 1777, Djezzar, master of Acre and Saide, has incessantly

fantly laboured to deftroy them. His perfecution forced them in 1784 to a reconciliation with the Drufes, and to enter into an alliance with the Emir Youfef. Though reduced to lefs than 700 armed men, they did more in that campaign than 15,000 or 20,000 Druzes and Maronites affembled at Dair-el-Kamar. They alone took the ftrong fortrefs of Mar-Djebaa, and put to the fword 50 or 60 Epirots who defended it. But the mifunderftanding which prevailed among the chiefs of the Druzes having rendered abortive all their operations, the pacha has obtained poffeffion of the whole valley, and the city of Balbek itfelf. At this period not more than 500 families of the Motoualis remained, who took refuge in Anti-Lebanon, and the Lebanon of the Maronites; and, driven as they now are from their native foil, it is probable they will be totally annihilated, and even their very name become extinct.

MOTTEUX (Peter), a French gentleman, born and educated at Rouen in Normandy. Coming over to England on account of the perfecution of the Proteftants, he became a confiderable trader in London, kept an Eaft-India warehoufe in Leadenhall-ftreet, and had a genteel place in the general poft-office, relating to foreign letters, being mafter of feveral languages. He was a man of wit and humour; and acquired fo perfect a maftery of the Englifh language, that he not only was qualified to oblige the world with a very good tranflation of Don Quixote, but alfo wrote feveral fongs, prologues, epilogues, &c. and what was ftill more extraordinary, became a very eminent dramatic writer in a language to which he was not a native. He was at laft, in the year 1718, found dead in a diforderly houfe, on his birth-day, when he completed his 58th year.

MOTTO, in armoury, a fhort fentence or phrafe, carried in a fcroll, generally under, but fometimes over, the arms; fometimes alluding to the bearing, fometimes to the name of the bearer, and fometimes containing whatever pleafes the fancy of the devifer.

MOUCHO MORE. See AGARICUS.

MOVEABLE, in general, denotes any thing capable of being moved.

MOVEABLE-Feafts, are fuch as are not always held on the fame day of the year or month; though they be on the fame day of the week. See FEASTS.

Thus, Eafter is a moveable feaft, being always held on the Sunday which falls upon or next after the firft full moon following the 21ft of March.

All the other moveable feafts follow Eafter, *i.e.* they keep their diftance from it; fo that they are fixed with refpect thereto.

Such are Septuagefima, Sexagefima, Afh-Wednefday, Afcenfion-day, Pentecoft, Trinity-Sunday, &c. which fee under their proper articles, SEPTUAGESIMA, &c.

MOVEABLE-Subject, in law, any thing that moves itfelf, or can be moved; in contradiftinction to immoveable or heritable fubjects, as lands, houfes, &c.

MOVEMENT, MOTION, a term frequently ufed in the fame fenfe with automaton.

The moft ufual movements for keeping time are watches and clocks: the firft are fuch as fhow the parts of time, and are portable in the pocket; the fecond, fuch as publifh it by founds, and are fixed as furniture. See HOROLOGY.

MOVEMENT, in its popular ufe among us, fignifies all the inner work of a watch, clock, or other engine, which move, and by that motion carry on the defign of the inftrument.

The movement of a clock or watch is the infide, or that part which meafures the time, ftrikes, &c. exclufive of the frame, cafe, dial-plate, &c.

The parts common to both of thefe movements are, the main-fpring, with its appurtenances; lying in the fpring-box, and in the middle thereof lapping about the fpring-arbor, to which one end of it is faftened. A-top of the fpring-arbor is the endlefs-fcrew and its wheel; but in fpring-clocks, this is a ratchet-wheel with its click, that ftops it. That which the main-fpring draws, and round which the chain or ftring is wrapped, is called the *fufy*; this is ordinarily taper; in large works, going with weights, it is cylindrical, and called the *barrel*. The fmall teeth at the bottom of the fufy or barrel, which ftop it in winding up, is called the *ratchet*; and that which ftops it when wound up, and is for that end driven up by the fpring, the *garde-gut*. The wheels are various: the parts of a wheel are, the hoop or rim; the teeth, the crofs, and the collet or piece of brafs foldered on the arbor or fpindle whereon the wheel is rivetted. The little wheels playing in the teeth of the larger are called *pinions*; and their teeth, which are 4, 5, 6, 8, &c. are called *leves*; the ends of the fpindle are called *pivots*; and the guttered wheel, with iron fpikes at bottom, wherein the line of ordinary clocks runs, the *pulley*. We need not fay any thing of the hand, fcrews, wedges, ftops, &c. See WHEEL, FUSY, &c.

Perpetual MOVEMENT. Many have attempted to find a perpetual movement, but without fuccefs; and there is reafon to think, from the principles of mechanics, that fuch a movement is impoffible: for though, in many cafes of bodies acting upon one another, there is a gain of abfolute motion, yet the gain is always equal in oppofite directions; fo that the quantity of direct motion is never increafed.

To make a perpetual movement, it appears neceffary that a certain fyftem of bodies, of a determined number and quantity, fhould move in a certain fpace for ever, and in a certain way and manner; and for this there muft be a feries of actions returning in a circle, otherwife the movement will not be perpetual; fo that any action by which the abfolute quantity of force is increafed, of which there are feveral forts, muft have its correfponding counter-action, by which the gain is deftroyed, and the quantity of force reftored to its firft ftate.

Thus by thefe actions there will never be any gain of direct force to overcome the friction and refiftance of the medium; fo that every motion being diminifhed by thefe refiftances, they muft at length languifh and ceafe.

MOUFET (Thomas), a celebrated Englifh phyfician, was born at London, and practifed medicine with great reputation. Towards the latter end of his life he retired to the country, and died about the year 1600. This phyfician is known by a work which was begun by Edward Wotton, and printed at London in 1634,

1634, folio, with the title of *Theatrum Insectorum.* A translation of it into English was published at London in 1658, folio. Martin Lister gives a very unfavourable opinion of this book: "As Moufet (says he) made use of Wotton, Gesner, &c. an excellent work might have been expected from him; and yet his *Theatrum* is full of confusion, and he has made a very bad use of the materials with which these authors have furnished him. He is ignorant of the subject of which he treats, and his manner of expression is altogether barbarous. Besides this, he is extremely arrogant, to say no worse; for though he has copied Aldrovandus in innumerable places, he never once mentions his name." But Ray thinks that Lister, by expressing himself in this manner, has not done justice to Moufet; and he mantains that the latter has rendered an essential service to the republic of letters.

MOUG-DEN, or Chen-yang; a city of Chinese Tartary, and capital of the country of the Mantchews or eastern Tartars. These people have been at great pains to ornament it with several public edifices, and to provide it with magazines of arms and storehouses. They consider it as the principal place of their nation; and since China has been under their dominion, they have established the same tribunals here as at Peking, excepting that called *Lii-pou:* these tribunals are composed of Tartars only; their determination is final; and in all their acts they use the Tartar characters and language. The city is built on an eminence: a number of rivers add much to the fertility of the surrounding country. It may be considered as a double city, of which one is enclosed within the other: the interior contains the emperor's palace, hotels of the principal mandarins, sovereign courts, and the different tribunals; the exterior is inhabited by the common people, tradesmen, and all those who by their employments or professions are not obliged to lodge in the interior. The latter is almost a league in circumference; and the walls which enclose both are more than three leagues round: these walls were entirely rebuilt in 1631, and repaired several times under the reign of Kang-hi.—Near the gates are two magnificent tombs of the first emperors of the reigning family, built in the Chinese manner, and surrounded by a thick wall furnished with battlements; the care of them is entrusted to several Mantchew mandarins, who at stated times are obliged to perform certain usual ceremonies; a duty which they acquit themselves of with the same marks of respect and veneration as if their masters were still living.

MOVING plants. See Hedysarum, Tremella, and Mimosa.

MOULD, or Mold, in the mechanic arts, &c. a cavity artfully cut, with design to give its form or impression to some softer matter applied therein. Moulds are implements of great use in sculpture, foundery, &c. The workmen employed in melting the mineral or metallic glebe dug out of mines, have each their several moulds to receive the melted metal as it comes out of the furnace; but these are different according to the diversity of metals and works. In gold mines, they have moulds for ingots; in silver mines, for bars; in copper and lead mines, for pigs or salmons; in tin mines, for pigs and ingots; and in iron mines, for sows, chimney-backs, anvils, caldrons, pots, and other large utensils and merchandizes of iron; which are here cast, as it were, at first hand.

Moulds of founders of large works, as statues, bells, guns, and other brazen works, are of wax, supported within-side by what we call a core, and covered without-side with a cap or case. It is in the space which the wax took up, which is afterwards melted away to leave it free, that the liquid metal runs, and the work is formed; being carried thither through a great number of little canals, which cover the whole mould. See Foundery.

Moulds of moneyers are frames full of sand, wherein the plates of metal are cast that are to serve for the striking of species of gold and silver. See Coining.

A sort of concave moulds made of clay, having within them the figures and inscriptions of ancient Roman coins, are found in many parts of England, and supposed to have been used for the casting of money. Mr Baker having been favoured with a sight of some of these moulds found in Shropshire, bearing the same types and inscriptions with some of the Roman coins, gave an account of them to the Royal Society. They were found in digging of sand, at a place called Ryton in Shropshire, about a mile from the great Watling-street road. They are all of the size of the Roman denarius, and of little more than the thickness of our halfpenny. They are made of a smooth pot or brick clay, which seems to have been first well cleansed from dirt and sand, and well beat or kneaded, to render it fit for taking a fair impression. There were a great many of them found together, and there are of them not unfrequently found in Yorkshire; but they do not seem to have been met with in any other kingdom, except that some have been said to be once found at Lyons. They have been sometimes found in great numbers joined together side by side, on one flat piece of clay, as if intended for the casting of a great number of coins at once; and both these, and all the others that have been found, seem to have been of the emperor Severus. They are sometimes found impressed on both sides, and some have the head of Severus on one side and some well known reverse of his on the other. They seem plainly to have been intended for the coinage of money, though it is not easy to say in what manner they can have been employed to that purpose, especially those which have impressions on both sides, unless it may be supposed that they coined two pieces at the same time by the help of three moulds, of which this was to be the middle one. If by disposing these into some sort of iron frame or case, as our letter-founders do the brass moulds for casting their types, the melted metal could be easily poured into them, it would certainly be a very easy method of coining, as such moulds require little time or expence to make, and therefore might be supplied with new ones as often as they happen to break.

These moulds seem to have been burnt or baked sufficiently to make them hard; but not so as to render them porous like our bricks, whereby they would have lost their smooth and even surface, which in these is plainly so close, that whatever metal should be formed in them would have no appearance like the sand-

holes

Mould. holes by which counterfeit coins and medals are usually detected.

Moulds of founders of fmall works are like the frames of coiners: it is in thefe frames, which are likewife filled with fand, that their feveral works are fafhioned; into which, when the two frames, whereof the mould is compofed, are rejoined, the melted brafs is run.

Moulds of letter-founders are partly of fteel and partly wood. The wood, properly fpeaking, ferves only to cover the real mould which is within, and to prevent the workman, who holds it in his hand, from being incommoded by the heat of the melted metal. Only one letter or type can be formed at once in each mould. See Letter-Foundery.

Moulds, in the manufacture of paper, are little frames compofed of feveral brafs or iron wires, faftened together by another wire ftill finer. Each mould is of the bignefs of the fheet of paper to be made, and has a rim or ledge of wood to which the wires are faftened. Thefe moulds are more ufually called frames or forms. See *Paper-making*.

Moulds, with furnace and crucible makers, are made of wood, of the fame form with the crucibles; that is, in form of a truncated cone: they have handles of wood to hold and turn them with, when, being covered with the earth, the workman has a mind to round or flatten his veffel.

Moulds for leaden bullets are little iron pincers, each of whofe branches terminates in a hemifpherical concave, which when fhut form an entire fphere. In the lips or fides where the branches meet, is a little jet or hole, through which the melted lead is conveyed.

Laboratory Moulds are made of wood, for filling and driving all forts of rockets and cartridges, &c.

Glaziers Moulds. The glaziers have two kinds of moulds, both ferving to caft their lead: in the one they caft the lead into long rods or canes fit to be drawn through the vice, and the grooves formed therein; this they fometimes call ingot-mould. In the other, they mould thofe little pieces of lead a line thick and two lines broad, faftened to the iron bars. Thefe may be alfo caft in the vice.

Goldfmiths Moulds. The goldfmiths ufe the bones of the cuttle-fifh to make moulds for their fmall works; which they do by preffing the pattern between two bones, and leaving a jet or hole to convey the filver through, after the pattern has been taken out.

Mould, among mafons, is a piece of hard wood or iron, hollowed within fide, anfwerable to the contours of the mouldings or cornices, &c. to be formed. This is otherwife called *caliber*.

Moulds, among plumbers, are the tables whereon they caft their fheets of lead. Thefe they fometimes call fimply *tables*. Befides which they have other real moulds, wherewith they caft pipes without foldering. See each defcribed under Plumbery.

Moulds, among the glafs-grinders, are wooden frames, whereon they make the tubes wherewith they fit their perfpectives, telefcopes, and other optic machines. Thefe moulds are cylinders, of a length and diameter according to the ufe they are to be applied to, but always thicker at one end than the other, to facilitate the fliding. The tubes made on thefe moulds are of two kinds; the one fimply of pafteboard and paper; the other of thin leaves of wood joined to the pafteboard. To make thefe tubes to draw out, only the laft or innermoft is formed on the mould; each tube made afterwards ferving as a mould to that which is to go over it, but without taking out the mould from the firft. See Grinding.

Mould, Mouldinefs.

Moulds ufed in bafket-making are very fimple, confifting ordinarily of a willow or ofier turned or bent into an oval, circle, fquare, or other figure, according to the bafkets, panniers, hampers, and other utenfils intended. On thefe moulds they make, or more properly meafure, all their work; and accordingly they have them of all fizes, fhapes, &c.

Mould, in fhip-building, a thin flexible piece of timber, ufed by fhipwrights as a pattern whereby to form the different curves of the timbers, and other compaffing pieces in a fhip's frame. There are two forts of thefe, viz. the bend-mould and hollow-mould; the former of thefe determines the convexity of the timbers, and the latter their concavity on the outfide, where they approach the heel, particularly towards the extremities of the veffel. The figure given to the timbers by this pattern is called their *bevelling*.

Moulds, among tallow-chandlers, are of two kinds: the firft for the common dipped caddles, being the veffel wherein the melted tallow is difpofed, and the wick dipped. This is of wood, of a triangular form, and fupported on one of its angles; fo that it has an opening of near a foot a-top: the other, ufed in the fabric of mould candles, is of brafs, pewter, or tin.—Here each candle has its feveral mould. See Candle.

Mould, among gold-beaters, a certain number of leaves of vellum or pieces of guts cut fquare, of a certain fize, and laid over one another, between which they put the leaves of gold and filver which they beat on the marble with the hammer. See Gold-leaf.

They have four kinds of moulds; two whereof are of vellum and two of gut: the fmalleft of thofe of vellum confifts of 40 or 50 leaves; the largeft contains 100: for the others, each contain 500 leaves. The moulds have all their feveral cafes, confifting of two pieces of parchment, ferving to keep the leaves of the mould in their place, and prevent their being difordered in beating.

Mould, in agriculture, a general name for the foft earthy fubftance with which the dry land is generally covered, and in which all kinds of vegetables take root and grow. It is, however, far from being an homogeneous fubftance; being compounded of decayed animal and vegetable matters, calcareous, argillaceous, and filiceous earths, all mixed together in various proportions, and with the different degrees of moifture, conftituting all the varieties of soil throughout the world. All kinds of mould contain fome inflammable fubftance, which remains in them from the decayed animals and vegetables; and they are more or lefs black in proportion to the quantity of phlogifton they contain. The black mould yields by diftillation a volatile alkali and oil.

MOULDINESS, a term applied to bodies which corrupt in the air, from fome hidden principle of humidity therein; and whofe corruption fhows itfelf by a certain white down or lanugo on their furface, which viewed through a microfcope appears like a kind of meadow, out of which arife herbs and flowers, fome only in the bud, others full-blown, and others decayed; each having its root, ftalk, and other parts. See Mucor.

MOULDING, any thing caft in a mould, or that feems to have been fo, though in reality it were cut with a chifel or the ax.

Mouldings, in architecture, projectures beyond the naked wall, column, wainfcot, &c. the affemblage of which forms corniches, door-cafes, and other decorations of Architecture. See that article.

MOULIN (Charles du), a celebrated civilian, and one of the moft learned men of the 16th century, was born of a confiderable family at Paris in 1500, and acquired great reputation by his fkill in the law. He publifhed many works, which have been collected together, and printed in five volumes folio; and are juftly confidered as the moft excellent works that France has produced on the fubject of civil law. He died at Paris in 1566.

Moulin (Peter du), a Proteftant divine, believed to be of the fame family with the former, was born in 1568. He taught philofophy at Leyden; and afterwards became chaplain to the princefs of Navarre. At the king of England's defire he came hither in 1615, and prepared a plan for the union of the Proteftant churches. The univerfity of Leyden offered him a profefforfhip of divinity in 1619: but he refufed it, and prefided at the fynod held by the Calvinifts at Alais in 1620. Some time after, being informed by Mr Drelincourt that the French king refolved to have him thrown into prifon, he retired to Sedan, where the duke de Bouillon made him profeffor of divinity, and minifter in ordinary. He was employed by the Calvinifts in the moft important affairs; and died at Sedan in 1658. His principal works are, 1. The anatomy of Arminianifm. 2. A treatife on repentance, and the keys of the church. 3. The Capuchine, or the hiftory of thofe monks. 4. The buckler of faith, or a defence of the reformed churches. 5. The judge of controverfies and traditions. 6. The anatomy of the mafs. 7. The novelty of Popery.

Peter du Moulin, his eldeft fon, was chaplain to Charles II. of England, and prebendary of Canterbury, where he died in 1684, aged 84. He wrote, 1. The peace of the foul, in French. 2. *Clamor regii fanguinis;* which Milton, by miftake, attributed to Alexander Morus. 3. A defence of the Proteftant religion, in Englifh.

MOULINET, is ufed, in mechanics, to fignify a roller, which, being croffed with two levers, is ufually applied to cranes, capftans, and other forts of engines of the like nature, to draw ropes, and heave up ftones, &c.

Moulinet is alfo a kind of turnftile, or wooden crofs, which turns horizontally upon a ftake fixed in the ground; ufually placed in paffages to keep out horfes, and to oblige paffengers to go and come one by one. Thefe moulinets are often fet near the outworks of fortified places at the fides of the barriers, through which people pafs on foot.

MOULINS, a town of France, and capital of Bourbonnois. The houfes of the Chartreux, and that of the Vifitation, are magnificent. It carries on a confiderable trade in cutlery ware, and is feated on the river Allier, in a pleafant fertile plain, almoft in the middle of France, 30 miles fouth of Nevers, and 55 north of Clermont. E. Long. 3. 25. N. Lat. 46. 34.

MOULTON (North), a town of Devonfhire on the river Moul, and the north fide of South Moulton, of whofe hundred it is a member, and anciently gave name to it, as the latter does now. It has two fairs, on Tuefday after May 11. and on Nov. 12.

Moulton (South), on the fame ftream, 182 miles from London. This, as well as the former, was anciently royal demefne. This corporation, which once fent members to parliament in the reign of Edward I. confifts of a mayor, 18 capital burgeffes, a recorder, town-clerk, and 2 ferjeants at mace. Here is a market on Saturdays; and fairs are held the firft Tuefday after May 11. and Nov. 12. Their chief manufactures are ferges, fhalloons, and felts; and great quantities of wool brought from the country are bought up here every Saturday. In the year 1684, a merchant of London, a native of this town, built and endowed a free fchool here; befides which, here is a charity-fchool.

MOULTING, or Molting, the falling off or change of hair, feathers, fkins, horns, or other parts of animals, happening in fome annually, in others only at certain ftages of their life.

The generality of animals moult in the fpring. The moulting of a hawk is called *mewing*. The moulting of a deer is the quitting of his horns in February or March. The moulting of a ferpent is the putting off his fkin. See Exuviæ.

MOUND, a term ufed for a bank or rampart, or other fence, particularly that of earth.

Mound, in heraldry, a ball or globe with a crofs upon it, fuch as our kings are ufually drawn with, holding it in their left hand, as they do the fceptre in the right.

MOUNT, an elevation of earth, called alfo *mountain*. See Mountain.

Mount-Edgecumbe, a prodigious high peak, at the entrance of Cook's ftrait, in New Zealand, on the weft fide. Its height is fuppofed not to be much inferior to that of the peak of Teneriffe.

Mount-Sorrel, a town in Leicefterfhire, fo named from a high mount or folid rock adjoining to the town, of a dufky red or forrel-coloured ftone, extremely hard. Of rough ftones hewn out of this rock the town is built. It has a market on Mondays. It was noted formerly for its caftle, and is feated on the river Stour, over which there is a bridge. It is 20 miles fouth-eaft by fouth of Derby, and 105 north-weft by north of London. W. Long. 1. 9. N. Lat. 52. 45.

Mounts of Piety, certain funds or eftablifhments in Italy, where money is lent out on fome fmall fecurity. There were alfo mounts of piety in England, raifed by contribution for the benefit of people ruined by the extortions of the Jews.

MOUNTAIN *(Mons)*, a confiderable eminence of land, elevated above every thing adjoining to it, and commanding all the furrounding places: It is commonly full of inequalities, cavities more or lefs expofed, and ftrata half laid open.

This name is likewife given to a chain of mountains; as when we fpeak of Mount Atlas in Africa; Mount Caucafus, which begins above Colchis and ends at the Cafpian fea; the Pyrenean mountains, which feparate France from Italy; and the Apennine mountains, which run through the whole of Italy.

Thofe who have furveyed the earth in general, and

ftudied nature on a grand fcale, have conftantly been ftruck with admiration and aftonifhment at the fight of fuch majeftic eminences, which extending in different ways, feem to rule over the reft of the globe, and which prefent to the beholder a fpectacle equally magnificent and interefting. In them it has been fuppofed we muft fearch for a folution of the important problem regarding the creation of the world.

Naturalifts reckon feveral kinds of mountains; we fhall find that thefe elevations of the earth have not all the fame origin, nor date their commencement from the fame era.

1. Thofe mountains which form a chain, and which are covered with fnow, may be confidered as *primitive* or antediluvian. They are like majeftic bulwarks fcattered on the furface of the globe, and greatly exceed the other mountains in height. In general, their elevation is very fudden, and their afcent very fteep and difficult. Their fhape is that of a pyramid crowned with fharp and prominent rocks, on which no verdure is to be feen, but which are dry, naked, and as it were ftripped of their foil, which has been wafhed away by the rains, and which prefent an awful and horrible afpect, fufficient to imprefs the coldeft imagination with terror. Thefe primitive mountains, which aftonifh the eye, and where wind only reigns, are condemned by nature to perpetual fterility. At the foot of them we frequently find paths lefs fteep and winding than when we afcend to a greater height. They every where prefent thundering cafcades, frightful precipices, and deep valleys. The depreffions and excavations correfpond with the quantity of water, the motion of which is accelerated in its fall, and which fometimes produces a total finking or an inclination of the mountain. The wrecks to be found at the foot of moft peaks, fhow how much they have fuffered from the hand of time. Nothing meets the eye but enormous rocks, heaped in confufion on one another, which prevent the approach of the human race. On the fummits of thefe mountains or high eminences, which are only a feries of peaks frequently detached from one another, the prominent rocks are covered with eternal fnow and ice, and furrounded with floating clouds which are difperfed into dew. In a word, the rugged cliffs oppofe an inacceffible rampart to the intrepidity of man; and nature exhibits a picture of diforder and decay (A). No fhells or other organized marine bodies are to be found in the internal part of thefe primitive mountains; and though fearch has been made, by digging, on the tops of the Alps and the Pyrenees, no fubftances of this nature have yet been difcovered except on the fides near the bafe. Nothing is to be met with but continued rocks, caverns dug by the hand of nature, and abounding in cryftallizations of great beauty, with various minerals. The ftone of which they confift is an immenfe mafs of quartz, fomewhat varied, which penetrates into the bowels of the earth in a direction almoft perpendicular to the horizon. We find no calcareous fpar but in the fiffures or rents which have fome extent and an evident direction; and at great depths we find new parts as it were, or, in other words, the primitive ftate of things. All primitive mountains furnifh proofs of thefe affertions. Of this kind in Europe are the Pyrenees, the Alps, the Apennines, the mountains of Tirol, the mountain of the giants in Silefia, the Carpathian mountains, the mountains of Saxony, thofe of Norway, &c. In Afia we find the Riphean mountains, Mount Caucafus, Mount Taurus, and Mount Libanus; in Africa, the mountains of the moon; and in America the Apalachian mountains, and the Andes or Cordilleras. Many of the latter have been the feats of volcanoes.

2. Another kind of mountains are thofe which are either detached, or furrounded with groups of little hills, the foil of which is heaped up in diforder, and the cruft gravelly and confufedly arranged together. Thefe are truncated or have a wide mouth in the fhape of a funnel towards the fummit, and which are compofed of, or furrounded with, heaps of calcined and half vitrified bodies, lava, &c. This clafs of mountains appear to have been formed by different ftrata raifed up and difcharged into the air, upon occafion of the eruption of fome fubterraneous fire. The ifles of Santorin, Monte-Nuovo, Mount Etna, Adam's Peak in the ifland of Ceylon, the peak of Teneriffe in the Canary Iflands, and many others, have been formed in this manner. When very high mountains of this kind are covered with fea-fhells, we may confider their fummits as having once conftituted a part of the bottom of the ocean. A number of thefe mountains have been formed in the memory of man; and prefent nothing to the view but difordered ruins, confufed maffes, parts heaped together in the greateft irregularity, and productions formed by eruptions or by the falling in of the earth. When a mountain of this

(A) It is obferved, fays the Abbé Palaffou, that at the foot of the Pyrenean mountains, the foil of feveral countries confifts wholly of the mud and rubbifh depofited by the rivers which defcend from them. According to Herodotus, a great part of Egypt was in like manner formed by the different fubftances brought thither by the Nile: Ariftotle calls it the work of the Nile; and on this account the Ethiopians boafted that Egypt was indebted to them for its orign. The inhabitants of the Pyrenees might fay the fame thing of almoft the whole tract of country fituated along the northern chain from the ocean to the Mediterranean, forming that kind of ifthmus which feparates the two feas. The furface of our globe is thus in a ftate of perpetual change; the plains are elevated, the mountains are levelled, and water is the principal agent employed by nature in thefe great revolutions. Time alone is wanting to verify the faying of Louis XIV. to his grandfon: Pofterity will one day be able to fay, "The Pyrenees are no more." The period, however, muft neceffarily be very diftant. M. Genfanne, from obfervations which he thinks well-founded, concludes, that thefe mountains are lowered about ten inches every century. Suppofing them therefore to be 1500 toifes above the level of the fea, and always fufceptible of being lowered in the fame degree, a million of years would elapfe before their total deftruction.

 this kind is connected with the land, and advances farther into the fea than the adjoining country, it is then termed a *Cape, Head*, or *Promontory*; fuch as the Cape of Good Hope at the fouthern extremity of Africa. Mountains of the fecond rank are commonly more eafy of accefs. Dr Haller obferves, that the angle formed between their bafe and their declivity is larger; that they have fewer fprings; and that their plants are different from thofe of the Alps. The peafants in Swifferland, he tells us, are acquainted with the difference betwixt thefe two kinds of mountains.

3. Thofe mountains, whether arranged in a group or not, the earth or ftone of which is difpofed in ftrata more or lefs regular, and confifting of one or more colours and fubftances, are produced by the fubftances depofited flowly and gradually by the waters, or by foil gained at the time of great floods. We daily fee little hills formed in this manner, which are always of a fmall height compared with thofe of the firft order, and round in the top, or covered with foil frequently forming a pretty flat and extenfive furface. We there find likewife fand and heaps of round pebbles like fuch as have been worn by the waters. The internal part of thefe mountains confifts of a heap of ftrata almoft horizontal, and containing a prodigious quantity of fhells, marine bodies, and fifh-bones. Although thefe mountains formed by ftrata fometimes degenerate into little hills, and even become almoft flat, they always confift of an immenfe collection of foffils of different kinds, in great prefervation, and which are pretty eafily detached from their earthy bed whether harder or fofter. Thefe foffils, confifting of marine fhells intermixed and confounded with heaps of organifed bodies of another fpecies, prefent a picture of aftonifhing diforder, and give indubitable indications that fome extraordinary and violent current has confounded and accumulated in the greateft diforder and precipitation foreign fubftances and fhells of various kinds. Thefe, removed from their natural and original place, by their union form an elevation and a mountain, which are in fact nothing but a compofition of the wrecks of bodies formerly organifed. All thefe phenomena feem to prove, that moft of thefe mountains chiefly owe their origin to the fea, which once covered fome parts of our continent, now left dry by its retreat. (According to the principles of this fyftem, Anaxarchus explained the formation of the mountains of Lampfacus). In thefe mountains we likewife find wood, prints of plants, ftrata of clay, marl, and chalk, different beds of ftone fucceeding one another, fuch as flate, marble which is often full of fea fhells, lime-ftone which appears to be wholly formed from the wreck of fhells, plafter-ftone, entire ftrata of ochre, and beds of bitumen, mineral falt, and alum.

The ftrata of mountains which are lower and of a recent date, or formed by recent accidents, fometimes appear to reft upon, or to take their rife from, the fides of primitive mountains which they furround, and of which they in fome meafure form the firft fteps in the afcent; and they end by being infenfibly loft in the plains. With refpect to the irregularity of fome ftrata in recent mountains, it is owing to violent and fudden inundations, to torrents, and to local revolutions which have produced angles, leaps, and finkings down of the ftrata. It is generally obferved, however, that the ftrata in mountains are exactly parallel to each other throughout all their different windings. M. Defmareft remarks, that in two mountains which by their brows form the hollow of a valley, we find ftrata of earth or ftone of the fame kind, and difpofed and arranged in the fame manner. We have already fhown, under the article EARTH, why the ftrata of recent mountains are not every where the fame in number and thicknefs. Some ftrata are only a quarter of an inch thick, others are more than ten feet: in fome places we find 30 or 40 beds fucceeding each other, in others only three or four. In recent mountains compofed of ftrata, M. Lehmann obferves, the loweft ftratum is always pit-coal; and this refts on a coarfe and ferruginous gravel or fand. Above the pit-coal we find ftrata of flate, fchiftus, &c. and the upper part of the ftrata is conftantly occupied by limeftone and falt-fprings. It is eafy to perceive the utility of thefe obfervations, when we intend to work for thefe minerals; and by attending to the diftinction which has been made of the different mountains of the fame kind, we may know the nature of thofe fubftances which upon fearch we may expect to find in them. The fpecimens which appear without, indicate what fubftances are concealed within.

In general, it has been obferved, that when two or more mountains run parallel to each other, the falient angles correfpond with the receding ones; and thefe angles are fharper and more ftriking in deep and narrow valleys. Dr Haller obferves, that there are many places in the Alps and in mountains, where two chains are prolonged contrary to the axis of the valley, and join fo as only to leave as much fpace as is neceffary for the difcharge of the water. In other places the mountain is continued, for inftance, to the north, and difcontinued to the fouth, where it opens into a valley. In others, the two chains retire and form a bend on each fide, the concavity of which fronts the axis: hence arife valleys almoft round and completely united.

It is likewife worthy of obfervation, that primitive mountains which form vaft chains are commonly connected together; that they fucceed one another for a fpace of feveral hundred leagues; and cover with their principal branches, and their various collateral ramifications, the furface of continents. Father Kircher and many others have obferved, that the principal chain generally runs from fouth to north, and from eaft to weft. The Cordilleras in the New world, Dr Haller obferves, extend from north to fouth; the Pyrenees have nearly the fame direction; the Alps run from eaft to weft; and there muft be a chain of this kind in Africa, for the great rivers in that quarter of the world run to the eaft on the one fide and to the weft on the other. The chain of Thibet appears to be parallel to the Alps; and, from the great length of the road through the fnows, it may be inferred that the mountains of Thibet have a very great elevation. Thofe mountains which, ftrictly fpeaking, are the principal roots, and the capital point of elevation and divifion, prefent very confiderable maffes, both with regard to their height and their fize or extent: they commonly occupy and traverfe the centre of continents.

Thofe

Mountain. Those which have a smaller elevation arise from these principal chains; they gradually diminish in proportion to their distance from their root, and at length wholly disappear either on the sea-coast or in the plains. Others are continued along the shore of the sea; their chain is interrupted only to make room for the waters of the ocean, under the bed of which the base of these mountains extends; and it again occurs in islands, which perpetuate their continuation till the whole chain re-appears. The highest mountains and the greatest number of islands are generally found between or near the tropics, and in the middle of the temperate zones; while the lowest are adjacent to the poles; though this does not always hold good without exception. M. Buache, a member of the Academy of Sciences at Paris, has laid down a system of physical geography concerning the structure of the terraqueous globe, considered with respect to the great chains of mountains which cross the continents and seas from pole to pole, and from east to west. According to this system, there is an uninterrupted series of mountains and high grounds which divide the earth into four declivities, from which the rivers descend. These chains of mountains are continued from one continent to another under the ocean; and the islands which are observed in it, are as it were the summits of the mountains. M. Buache's work is entitled *Tables et Cartes de la Geographie physique*. But that this system, with regard to the islands, must be erroneous, will appear evident from our article EARTH.

In the *Journal de Physique* for May 1779 we are informed, that Dr Pallas, who has travelled through Siberia, and almost all the Russian empire in the north of Asia, thinks he has discovered the insufficiency of the principal systems hitherto proposed to account for the formation of mountains. This accurate observer has prosecuted the study of mountains by traversing immense regions, and visiting as it were the secret work shops of nature in almost the fourth part of our hemisphere. He has not trusted to the vague reports of others, but from observations which he himself had occasion to make for the space of ten years. He has, in a work entitled *Observations on Mountains*, explained both the direction of the northern chains, and the particular composition of each. He is thence led to make an ingenious conjecture concerning the formation of the principal groups of mountains, and concerning the irregular distribution and the figure of the old continent. Under the article EARTH an account is given of the different systems which have been formed concerning the formation and configuration of our globe. To establish a general system, it would perhaps be necessary to have travelled over the whole earth; and to have studied all the chains of mountains, their direction, and particular composition, for a long series of years. Thus very little attention is required to perceive, in the different systems mentioned under the article EARTH, the influence of climate and local situation. Burnet, Whiston, and Woodward, who were acquainted only with England, where very few great chains of mountains are to be seen, where they are almost all insulated or detached, and where the soil of extensive plains is formed by horizontal and pretty regular strata, naturally thought that these general and concentric strata were to be found all around the globe, and considered mountains as nothing but the wrecks of these strata, either raised or swallowed up by the violence of the waters. Scheuchzer, who studied among the steep mountains of Switzerland, amid rocks of granite, petrosilex, jasper, and hard stones, and who found nothing on the most elevated plains of the Alps but strata of similar substances, had recourse to the power of the Almighty, who broke in pieces these strata, and elevated their splinters into the form of mountains. Ray, Morro, and Stenon, who saw nothing all around them but burning mountains and traces of volcanic productions—deceived by the constitution of the hills of Italy, which are almost all formed of lava, pozzolana, and basaltic substances, and by the origin of the Monte Nuovo, which rose up almost before their eyes, have considered great mountains as formed by a cause which undoubtedly has a secondary, but to which they have ascribed a primary and principal, influence. M. de Buffon, who delineated nature at the foot of the utmost extremity of the French Alps, and who perceived them gradually attain a greater elevation as they advanced towards the southern parts of France and towards Savoy, concluded from his theory, and in support of the same theory, that the highest mountains were near the equator; that they became lower towards the poles; and that, being produced by the flux and reflux of the sea, they were formed of the substances which it deposited.

We shall now lay before our readers the geographical description of the directions of the principal mountains, and of that kind of connection which subsists betwixt them. This description differs from that of M. Buache, and may be read with a map of the world before us.

M. Buache places the most elevated points of the great chains of mountains under the equatorial line: but, according to the author whom we follow in this place, the fullest and most continuous lands, and perhaps likewise the most elevated, are to be found at a distance from the equator, and towards the temperate zones. If, in fact, we survey the globe's surface, we will not be able to perceive that chain of mountains, which running from east to west, and dividing the earth into two portions, ought again to meet. On the contrary, extensive plains seem to accompany the line through almost its whole extent. In Africa, the deserts of Nigritia and those of Upper Ethiopia, are on the one side of the line; and on the other are the sandy plains of Nicoco, Caffraria, Monoemugi, and Zanguebar. From the eastern shores of Africa to the Sunda islands, is a space of 1500 leagues of sea with almost no islands, except the Laccadive and Maldive islands; most part of which have little elevation, and which run from north to south. From the Molucca islands and New Guinea, to the western borders of America, the sea occupies a space of 3000 leagues. Though Chimboraço and Pichincha in America, the two highest mountains which have been measured, are near and even under the line, yet from this no conclusion can be drawn; because on one side these mountains run in a direction not parallel to the equator; the Andes or Cordilleras attain a greater elevation as they remove from the equator towards the poles; and a vast plain is found exactly under the line, between the Oroonoko and the river of the Amazons. Besides, the latter river, which

Mountain. which takes its rise in the province of Lima about the 11th degree of south latitude, after crossing the whole of South America from west to east, falls into the ocean exactly under the equator. This shows that there is a descent for the space of 12 degrees or 300 leagues. From the mouth of the river of the Amazons, to the western shores of Africa, the sea forms another plain of more than 50 degrees.

From the few certain facts and accurate observations which we have received from well informed travellers, we might almost affirm that the most elevated land on our globe is situated without the tropics in the northern and southern hemispheres. By examining the course of the great rivers, we in fact find that they are in general discharged into three great reservoirs, the one under the line, and the other two towards the poles. This, however, we do not mean to lay down as a thing universally true; for it is allowed, that, besides the two elevated belts, the whole surface of the earth is covered with innumerable mountains, either detached from one another or in a continued chain. In America, the Oronooko and the river of the Amazons run towards the line, while the river St Lawrence runs towards the 50th degree of north latitude, and the river de la Plata towards the 40th degree of south latitude. We are still too little acquainted with Africa, which is almost all contained within the tropics, to form any accurate conclusions concerning this subject. Europe and Asia, which form only one great mass, appear to be divided by a more elevated belt, which extends from the most westerly shores of France to the most easterly of China, and to the island of Sagaleen or Anga-hata, following pretty nearly the 50th degree of north latitude. In the new continent, therefore, we may consider that chain where the Mississippi, the river St Lawrence, the Ohio, and the river de los Estrechos, take their rise, as the most elevated situation in North America: whence the Mississippi flows towards the equator, the river St Lawrence towards the north-east, and the rest towards the north-west. In the old continent, the belt formerly mentioned, and to which we may assign about 10 degrees in breadth, may be reckoned from the 45th to the 55th degree of north latitude: for in Europe the Tagus, the Danube, the Dnieper, the Don, and the Volga, and in Asia the Indus, the Ganges, the Meran, the Mecon, the Hoang-ho, and the Yantg-tse-Kiang, descending as it were from this elevation, fall into the great reservoir between the tropics; whilst towards the north the Rhine, the Elbe, the Oder, the Vistula, the Obi, the Jenisei, the Lena, the Indigirka, and the Kowyma, are discharged into the northern reservoir.

Judging from those mountains the height of which has been calculated, and from the immense chains with which we are acquainted, we may infer that the highest mountains are to be found in this elevated belt. The Alps of Swisserland and Savoy extend through the 45th, the 46th, and the 47th degrees. Among them we find St Gothard, Furca, Bruning, Rufs, Whiggis, Scheidek, Gunggels, Galanda, and lastly that branch of the Swiss Alps which reaches Tirol by the name of Arlenberg and Arula. In Savoy, we meet with Mount Blanc, the Peak of Argentiere, Cornero, Great and Little St Bernard, Great and Little Cenis, Coupeline, Servin, and that branch of the Savoyard Alps which proceeds towards Italy through the duchy of Aost and Montferrat. In this vast heap of elevated peaks, Mont Blanc and St Gothard are particularly distinguished. The Alps, leaving Swisserland and Savoy, and passing through Tirol and Carniola, traverse Saltzbourg, Stiria, and Austria, and extend their branches through Moravia and Bohemia, as far as Poland and Prussia.—Between the 47th and 48th degrees, we meet with Grimming the highest mountain of Stiria, and Priel which is the highest in Austria. Between the 46th and 47th degrees, the der Bacher and the der Reinschnicken, form two remarkable chains. The upper one, which traverses the counties of Trencsin, Arrava, Scepus, and the Kreyna, separates Upper Hungary from Silesia, Little Poland, and Red Russia; the inferior one traverses Upper Croatia, Bosnia, Servia, and Transilvania, separates Lower Hungary from Turkey in Europe, and meets the upper chain behind Moldavia, on the confines of Little Tartary. In these mountains are situated the rich mines of Schemnitz.

To form a general idea of the great height of this Alpine belt, it is necessary only to remark, that the greatest depth of the wells at Schemnitz is 200 toises; and yet it appears, from the barometrical calculations of the learned M. Noda, that the greatest depth of these mines is 286 toises higher than the city of Vienna. The granito-argillous mountains of Schemnitz, and of the whole of this metallic district, are inferior, however, to the Carpathian mountains. Mount Krivany in the county of Arrava, and the Carpathian mountains between Red Russia and the Kreyna, appear by their great elevation to rule over the whole of the upper Alpine chain. In the inferior chain we likewise meet with mountains of an extraordinary height; among others, Mount Mediednik, which gives its name to a chain extending far into Bosnia; and Mount Hemus, celebrated even among the ancients. In short, this extensive chain reaches into Asia, and is there confounded with another chain no less famous, which, following exactly the 50th degree of latitude, runs through the whole of Asia. This chain of mountains is described by Dr Pallas in the work above-mentioned; and we shall now trace its course in company with this intelligent observer.

This author places the head of the mountains of Oural, between the sources of the Taik and the Bielaïa, about the 53d degree of latitude, and the 47th of longitude. Here the European Alps, after having traversed Europe, and sent off various branches which we shall afterwards examine, lose their name, which is changed into that of the Ouralic or Uralian mountains, and begin their course in Asia. This lofty chain, which separates Great Bulgaria from the desarts of Ischimska, proceeds through the country of the Eleuths, follows the course of the river Irtis, approaches the lake Teleskaia, and afterwards forms a part of the same system of mountains with the Altaic chain. There they give rise to the Oby, the Irtis, and the Jenisei, which begin their course about the 50th degree of north latitude, and fall into the Frozen Ocean.

The Altaic chain, after having embraced and united all the rivers which supply the Jenisei, is continued under

under the name of *Saianes*, without the ſmalleſt interruption, as far as the Baikal lake. The extenſion of this chain to the ſouth forms that immenſe and elevated plain which is loſt in Chineſe Tartary, which may be compared with the only plain in Quito, and which is called *Gobi* or *Chamo*. The Altai afterwards interpoſing between the ſource of the Tchikoi and of the rivers which ſupply the Amur or Sagaleen, riſes towards the Lena, approaches the city Jakuck beyond the 60th degree of latitude, runs from that to the ſea of Kamtſchatka, turns round the Ochockoi and Penſink gulphs, joins the great marine chain of the Kurile iſles near Japan, and forms the ſteep ſhores of Kamtſchatka, between the 55th and 60th degrees of latitude. Such is the direct courſe of the high mountains conſtituting the belt which, we imagine, is to be found in the northern hemiſphere, and which, after becoming lower, paſſing under the ſea, and forming by means of their elevated peaks that archipelago of iſlands which derives its name from the unfortunate Bhering, again riſe and enter North America, on the weſtern ſide, about the Straits of Anian. After running in the ſame parallel, and giving riſe to the Ohio, the Riviere-Longue, the river St Lawrence, and the Miſſiſſippi, they are loſt in Canada. From the eaſtern ſhores of America to the weſtern ſhores of Europe, we find a vaſt interruption. Perhaps the chain was at firſt continued completely round the globe; but extraordinary revolutions, by ſeparating the old and new continents, may have occaſioned this diviſion, and left nothing but the Azores and ſome detached points as a monument of what formerly exiſted, till we come to the Britiſh iſles.

Before we proceed to inquire whether a belt of a ſimilar elevation exiſts in the ſouthern hemiſphere, we may remark thoſe branches and ramifications which the great northern Alpine belt ſends forth both towards the equator and the antarctic pole. Theſe new chains, which gradually become lower as they approach the boundary towards which they tend, appear a ſufficient proof that the equator is not the moſt elevated part of the earth.

The European Alps produce three principal chains, which run towards the equator, and ſome ſmaller ones running towards the pole. The firſt ſouthern chain is ſent out through Dauphiné; traverſes Vivarais, Lyonnois, Auvergne, Cevennes, and Languedoc; and, after joining the Pyrenees, enters Spain. There it divides into two or three ramifications, one of which runs through Navarre, Biſcay, Arragon, Caſtile, Marche, and Sierra Morena, and extends into Portugal. The other, after traverſing Andaluſia and the kingdom of Granada, and there forming a number of ſierras, again makes its appearance, beyond the Straits of Gibraltar, in Africa, and coaſts along its northern ſhores under the name of *Mount Atlas*.—The ſecond principal chain of the Alps paſſes out through Savoy and Piedmont; ſpreads its roughneſſes over the ſtates of Genoa and Parma; forms the belt of the Apennines; and after frequently changing its name, and dividing Italy into two parts, terminates in the kingdom of Naples and in Sicily, producing volcanoes in every part of its courſe. The third chain is ſent off from Hungary, and ſcatters innumerable mountains over all Turkey in Europe, as far as the Morea and the Archipelago at the bottom of the Mediterranean ſea. The northern branches, though ſmaller at firſt, are no leſs clearly defined; and ſome of them even extend their ramifications as far as the Frozen Ocean. An Alpine branch, iſſuing from Savoy thro' the country of Gex, proceeds through Franche Comte, Suntgaw, Alſace, the Palatinate, and Veterabia.—Another iſſues from the territory of Saltzbourg, paſſes along Bohemia, enters Poland, ſends off a ramification into Pruſſia towards the deſerts of Waldow, and after having paſſed through Ruſſia is loſt in the government of Archangel.

The Aſiatic Alps ſend forth in like manner ſeveral branches both to the ſouth and north. The Ouralic mountains, between the ſources of the Bielaïa and the Jaik, produce three principal branches; the firſt of which, including the Caſpian Sea in one of its diviſions, enters Circaſſia through the government of Aſtracan, paſſes through Georgia under the name of *Caucaſus*, ſends a vaſt number of ramifications to the weſt into Aſiatic Turkey, and there produces the mountains Tſchilder, Ararat, Taurus, Argée, and many others in the three Arabias; while the other diviſion, paſſing between the Caſpian Sea and the lake Aral, penetrates through Choraſan into Perſia. The ſecond branch, taking a more eaſterly direction, leaves the country of the Eleuths; reaches Little Bucharia; and forms the ramparts of Gog and Magog, and the celebrated mountains formerly known by the name of *Caf*, which M. Bailly has made the ſeat of the war between the Dives and the Peris*. It traverſes the kingdoms of Caſgar and Turkeſtan, enters through that of Lahor into the Mogul territory, and, after giving riſe to the elevated deſert of Chamo forms the weſtern peninſula of India. While theſe two branches run towards the ſouth, the third branch of the Ouralic chain riſes towards the north, following almoſt the 79th degree of longitude, and forms a natural boundary between Europe and Aſia; without, however, bounding the immenſe empire of Ruſſia. This chain, after coming oppoſite to Nova Zembla, divides into two conſiderable branches. The one, running to the north-eaſt, paſſes along the Arctic ſhores; the other, proceeding towards the north-weſt, meets the northern European chain, traverſes Scandinavia in the ſhape of a horſeſhoe, covers the low-lands of Finland with rocks; and, as is obſerved by Dr Pallas, appears to be continued from the North Cape of Norway through the marine chain of Spitzbergen, ſcattering iſlands and ſhelves perhaps throughout the northern ocean, that, paſſing through the pole, it may join the northern and eaſtern points of Aſia and North America.

* *Lettres ſur les Atlantides*, let. 16.

The Ouralic, which in the country of the Mongols becomes the Altaic chain, proceeds towards the equator. After forming the mountains and caverns wherein, as we are told, the aſhes of the Mongol emperors of the race of Ghengis-Kan are depoſited, together with the vaſt plain of Chamo, conſiſting of arid ſand, and the frightful rocks and precipices of Thibet, which form the myſterious and deſert retreats of the Grand Lama, it croſſes the rivers Ava and Menan; contains in its ſubdiviſions the kingdoms of Ava, Pegu, Laos, Tonquin, Cochinchina, and Siam; ſupports the peninſula of Malacca; and overſpreads the Indian ocean with the iſles of Sonda, the Moluccas, and the Philippines. From the borders of the Baikal lake and of the province of Selinginſkoy,

Mountain. ginfkoy, a branch is detached, which fpreads over Chinefe Tartary and China, is continued into Corea, and gives rife to the iflands of Japan.

The great chain having extended to the north, near the city of Jakuck, upon the banks of the Lena, fends off one of its branches to the north-weft, which paffing between the two Tungufta, is loft in marfhy grounds lying in the northern parts of the province of Jenniffeifkoy. The fame chain, after it has reached the eaftern part of Afia, is loft in the icy regions of the north about Nos-Tfchalatfkoy or the icy Promontory, and Cap Czuczenfkoy.

It will be more difficult, perhaps, to trace the elevated belt in the fouthern hemifphere beyond the tropic of Capricorn, than it has been to diftinguifh that towards the north. An immenfe extent of ocean feems to occupy the whole Antarctic part of the globe. The greateft fouth latitude of the old continent is not more than 34 degrees, and South America fcarcely extends to the 55th degree. In vain has the enterprifing Cook attempted to difcover regions towards the pole: his progrefs was conftantly interrupted by tremendous mountains and fields of ice. Beyond the 50th degree no land and no habitation is to be found. The iflands of New Zealand are the fartheft land in thefe defert feas; and yet the fouth cape of Taral-Poenamoo extends only to the 48th degree: We do not mention Sandwich-land, which is fituated in the 58th degree, becaufe it is too fmall and too low. It muft be recollected, however, that according to the declarations of travellers, the Cordilleras become higher as they advance fouthward to the Straits of Magellan; and that the Terra del Fuego, which lies in the latitude of 55, is nothing but a mafs of rocks of prodigious elevation. America, however, exhibits to our view elevated points, whence chains of mountains are diftributed in different directions over the whole furface of the new continent. There muft likewife be great refervoirs, where the moft remarkable rivers take their rife, and from which they neceffarily defcend towards their mouth. In the fouthern hemifphere, this elevated belt is nearer the equator; and though it does not extend to the 50th degree, it is evidently to be met with and may be accurately traced between the 20th and 30th degrees. The high mountains of Tucuman and of Paraguay, which interfect South America about the 25th degree of latitude, may be confidered as the American Alps. If we look into the map of the world, we will be able to diftinguifh an elevated belt all along this parallel. In Africa, Monomotapa and Caffraria are covered with very high mountains, from which pretty large rivers defcend. In the Pacific Ocean, we find New Holland, New Caledonia, the New Hebrides, and the Friendly and the Society iflands, under the fame parallel. We may, therefore, with fufficient propriety, diftinguifh this parallel by the name of the *Southern Alps*, as we have already diftinguifhed the elevated belt of the 50th degree of north latitude by that of the *Northern Alps*. In America, the Rio de la Plata, which after a courfe of 500 leagues falls into the ocean at the 35th degree of fouth latitude; the Pavana, which rifes from the mountains of the Arapes, and falls into the Plata at Corriente; the great number of rivers which flow into that of the Amazons, fuch as the Paraba, which receives in its courfe the tribute of more than 30 other rivers; the Madera, the Cuchirara, the Ucayal, &c. &c. all defcend from thefe fouthern Alps. From thefe Alps likewife three confiderable branches of mountains are detached, which go by the common name of *Andes* or *Cordilleras*.—The firft branch, which extends towards the fouth, and paffes out from Paraguay through Tucuman, feparates Chili from thefe provinces and from Chimito, and is continued through the Terra Magellanica as far as Terra del Fuego. The fecond branch, directing its courfe towards the equator, traverfes Peru, in vain endeavouring to conceal treafures which the avarice of men has taught them to difcover in its bowels; bounds the Spanifh Miffions; enters Terra Firma thro' Popayan; and unites South and North America by the ifthmus of Panama The third divifion, iffuing from Paraguay through Guayra and the territory of Saint-Vincent, traverfes Brazil, diftributes ramifications into Portuguefe, French, and Dutch Guiana, croffes the Oroonoko, forms the mountains of Venezuela, and near Carthagena meets the fecond branch coming from Popayan.

We have already fuppofed, that the elevated belt of North America was fituated about the 45th degree of north latitude; and there we imagined we recognized the continuation of the northern Alps of the old continent. This chain likewife fends forth confiderable branches on both fides. One of them is detached acrofs the fources of the Miffiffippi, the Belle-Riviere, and the Miffouri, and at the entrance of New Mexico divides, in order to form California to the weft, and the Apalachian mountains to the eaft.—Thence proceeding through New Bifcay, the audience of Guadalaxara, Old Mexico, and Guatimala, it meets at Panama the fouthern branch, which is part of the Alps of Paraguay. The fecond branch, following the courfe of the Miffiffippi, feparates Louifiana from Virginia; ferves as a bulwark to the United States of America; forms the Apalachian mountains in Carolina; and at laft, traverfing Eaft Florida, inclofes the Gulph of Mexico with the Great and Little Antilles. In the north, we can trace the branches of the elevated belt; on one fide obferve them proceeding towards Canada, directing their courfe through Labrador to Hudfon's Straits, and at length confounded with the rocks of Greenland, which are covered with eternal fnow and ice. On the other fide, we fee them rifing through the country of the Affinipoels and the Kriftinos, as far as Michinipis and the northern Archipelago.

We have thus traced the directions of the great chains of mountains. There are certain projecting and pretty fenfible points on the globe, which appear to fupply every region with great rivers and high mountains. The Alps of Switzerland and Savoy in Europe, the union of the Ouralic mountains in Afia, (B) the Andes of Tucuman and Paraguay in South America, and the high countries, whence the Miffiffippi,

(B) Thefe M. Bailly confiders as the moft elevated art of the globe. *Lettres fur les Atlantides*, p. 236.

Mountain. ſſippi, the river Saint Lawrence, and the Belle Riviere deſcend, may be conſidered as ſome of theſe; though M. Buache places them much nearer the equator, and even under the line. But his object was to form a ſyſtem to ſupport his own, and to confirm another; ours is merely to ſtate what we have obſerved, and what indeed muſt occur to every one who ſurveys the ſurface of the globe as it is delineated by our beſt geographers.

So many obſervations fully ſhow that the primitive mountains may be conſidered as the foundation of our globe. By their ſhape, elevation, direction, and continuity, they give riſe to the greateſt part of winds, or produce that variety which prevails among them. Primitive mountains, as we have already ſaid, are diſtinguiſhed likewiſe by their internal ſtructure, by the nature of the ſtones of which they are compoſed, and by the minerals which they contain. The higheſt mountains are, properly ſpeaking, nothing but peaks or cones conſiſting of ſolid rock. This pyramidal form has been ſuppoſed to be at firſt owing to a kind of cryſtallization; and the late M. Rouelle was of opinion, that the ſubſtances of which our globe is compoſed originally ſwam in a fluid. The ſimilar parts of which the great mountains conſiſt, according to this philoſopher, approached one another and formed a cryſtallization, ſometimes in a group, and at other times detached at the bottom of the waters. Upon this ſuppoſition, we might analyſe different portions or blocks of rock taken from primitive mountains; and by making them cryſtalliſe, we would then have in miniature a part of the ſame economy or connection of mountains, a figurative portion, in ſhort, of the ſkeleton of the earth.—We may farther preſume, that thoſe ſteep rocks which it now ſeems almoſt impoſſible to ſurmount even in imagination, are co-eval with the exiſtence of the world.

Mountains with flat ſummits ſometimes reſt on the baſe of primitive mountains; and contain marble, foſſils, and limeſtone. When mountains of the ſame kind poſſeſs a round and more regular ſhape, they conſiſt of chalk and other calcareous and friable ſubſtances arranged in ſtrata. Granite-argillous mountains, like thoſe of Shemnitz, generally form metallic diſtricts. Hills compoſed of brown free-ſtone every where preſent irregular points, indicating broken ſtrata and heaps of rubbiſh.

Dr Pallas (in the ſyſtematic part of the Memoir above mentioned, concerning the ſubſtances of which the higheſt mountains are compoſed) lays it down as an axiom, that the higheſt mountains of the globe forming continued chains, are compoſed of that rock which is called *granite*, the baſe of which is always a quartz, with a greater or ſmaller mixture of felt-ſpar, mica, and ſmall ſchoerls, ſcattered without order, and in irregular fragments of different ſizes. This old rock, and the ſand ariſing from its decompoſition, form the baſe of all continents. Granite is found below mountains compoſed of ſtrata (this obſervation is not applicable to the courſes of mountains formed by ſtrata); it conſtitutes the large protuberances, and as it were the heart, of the greateſt Alps in the known world: hence we may with the greateſt probability infer, that this rock forms the principal ingredient in the internal compoſition of our globe. It is never found in regular ſtrata, but in huge maſſes and in ſhapeleſs blocks; its origin is prior to that of all animated beings; it exhibits not the ſmalleſt traces of petrifaction, and ſeems not to have received the leaſt impreſſion from any organiſed ſubſtance. High eminences, whether in continued chains or in the form of ſteep peaks, are never covered with clayey or calcareous ſtrata, deriving their origin from the ſea; but appear to have been from their very firſt formation elevated above the level of the ocean. The ſides of theſe great chains are for the moſt part covered with ſchiſtous belts, and ſurrounded with mountains of the ſecond and third orders. This is proved by the Ouralic and Altaic chains, which have been traced by Dr Pallas. Such is the ſyſtem propoſed by this author. The high or primitive and ancient mountains, which have exiſted from the beginning of time, are granitous; the ſchiſtous mountains, to which he gives the name of *ſecondary*, have ariſen from the ſides of the primitive by the decompoſition of the granite; and thoſe which he calls *tertiary* mountains, or mountains of the third order, are nothing but ſubſtances depoſited by the ſea, and raiſed up by volcanoes, or ſwept away by a violent irruption, a powerful inundation, or an univerſal deluge. This hypotheſis concerning the formation of mountains is borrowed from nature itſelf, and appears to be confirmed by many facts in natural hiſtory.

We ſhall now proceed to ſtate the height of moſt of the primitive mountains; an object no leſs worthy of attention than their ſtructure and variety.

According to M. Pontoppidan, the higheſt mountains in Norway are 3000 toiſes in height. According to M. Brovallius, the higheſt mountains in Sweden are 2333 toiſes. It is ſuppoſed, however, that both theſe calculations are erroneous.

From the Memoirs of the Academy of Sciences at Paris, it appears, that the mountains in France moſt elevated above the ſurface of the Mediterranean are the Puy-de-Dome, which is 817 toiſes, and the Mont d'Or, which is 1048 toiſes. Theſe two mountains are in Auvergne, and are ſuppoſed to be extinguiſhed volcanoes. Mount Cantal is 993 toiſes high: Mount Ventoux is 1036: the ſouth peak of Canigou in the Pyrenees, according to M. de Rocheblave, is 1442; and according to M. de Plantade, 1453: and Saint Barthelemi is 1184.

M. Needham obſerves, that the higheſt Alps in Savoy are the convent of the great Saint Bernard, at the point of the rock to the ſouth-weſt of that mountain, which is 1274 toiſes; Mount Sérené, which is 1283; and Mount Tourné, which is 1683. According to the meaſurement of the Engliſh obſerver, the peak or needle of Argentiere is 2094 toiſes high. M. Facio de Duiller and M. Duluc make the ridge of Mont Blanc 2213 toiſes; but according to the obſervation of M. Shuckburgh, its elevation is 2447 toiſes one foot (by M. de Sauſſure's meaſurement 2426 toiſes) above the level of the Mediterranean.

The principal mountains of the Alps are among the moſt elevated in the world; and particularly Mont-Blanc, that enormous maſs of granite, which is ſituated in the centre of the Alps, and the acceſs to which is rendered ſo difficult by the ſharp peaks, walls of ice, and everlaſting ſnows wherewith it is covered, is the higheſt

Mountain. highest mountain which has been measured either in Europe, Asia, or Africa. The altitude of the Alps of Switzerland has been ascertained by different philosophers: We shall content ourselves with mentioning the most remarkable of those mountains covered with snow, which in Switzerland are called *Gletschers* or *Glaciers*. St Gothard, according to Scheuchzer, is 1650 toises; and Lignon, near the lake of Como, north-east, is, according to Pini, 1486 toises in height. M. Pasumot, engineer to the king of the French, justly observes, that the heights assigned by Mikheli to the mountains of Switzerland appear rather to be ideal computations than founded on observations. An opinion of them may be formed from the following: According to this author, Mount Pilate or Frakmont, in the district of Lucerne, is 1403 toises in height; Mount Cenis, 1445; Raukhstok, 1760; the Nolle ridge of Titlisberg, 2001; Ghemi, 2421; Grimselberg, in the canton of Berne, 2539; the Cornera, part of Loukmanier, 2654; Fourke, 2669; Schrekhorn, 2724; and St Gothard, at its most elevated point, 2750. Mikheli likewise reckons 20 other mountains, the height of which exceeds 2000 toises. The reader may consult the *Table comparative des hauteurs des principales montagnes*, by M. Pasumot (*Journal de Physique*, September 1783.)

Throughout the globe we will not perhaps meet with higher mountains than those of Peru, which go by the name of *Cordilleras de los Andos*. According to the observations of the academicians sent to South America in 1735 by the Spanish and French courts to measure a degree of the meridian and to ascertain the true figure of the earth, the principal summits of these extraordinary mountains, which are situated near Quito, and which are constantly covered with snow though they lie under the equator, have the following geometrical elevations above the level of the sea: Quito-Capilate, 1707 toises; El-Corason, 2470 (C); Cotacatche, 2570; Ek-Atlas, 2730; and Noyamble-orcu, under the line, 3030. All the other mountains have been, or still are, volcanoes. The following is an enumeration of them, together with their several heights: Pichincha, 2430; Cargavi-raso, 2450; Sinchonalagon or Sinchoulagoa, 2570; Sangai, 2680; Illinika 2717, Kotopaxi, 2950; Antisana, 3020; Cagambeorcon, situated under the line, 3030; Cimboraso or Chimboraço, 3220. The last mentioned mountain, which forms part of the Cordilleras in Peru, is one of the largest and probably the highest in the world. It is seen at sea from the gulph of Guayaquil, which is more than 60 leagues distant.

Other very elevated mountains are Mount Sinai in Japan; Mount Caucasus in Asia; the southern peak of the Pyrenees; the peak of Teneriffe in one of the Canary islands, which according to M. Bouguer is 2100 toises (according to later observations, made by M. M. de Verdun, de Borda, and Pingré, French academicians, in 1754, the peak of Teyde, more commonly known by the name of the *peak of Teneriffe*, is only 1904 toises perpendicular height above the level of the sea); Mount Gibel or Etna in Sicily is 1672 toises; St George's peak in the Azores; Adam's peak in Ceylon; the mountains of the Moon; Mounts Athos, Olympus, Taurus, and Emaus; Mount Cenis in the Alps on the road from France to Italy, is 1460 toises; the Great and Little Atlas; and many others, on the top of which we feel, even in the middle of summer, a more piercing cold than that of the severest frosts of our climates. After this, it cannot appear wonderful that the vapours which reach so great heights are there congealed; and that the summits of these mountains, even in the warmest climates, are constantly covered with snow, while the inhabitants of the plain enjoy a temperate atmosphere, or are subject to extreme heat. The height of these mountains, added to their being placed on the most elevated parts of the globe, is the chief cause of the phenomena peculiar to them. In that part of Asia which is separated by the chain of mountains called the *Ghauts*, there are two very different seasons at one and the same time. While it is winter on the Malabar coast, for instance, the Coromandel coast, which has the same degree of elevation, and in some places is only 20 leagues distant, enjoys an agreeable spring or the temperature of autumn. The traveller in the Alps generally experiences, even in summer, the four seasons of the year. In the Andes we meet with a change of temperature no less curious; for as we descend from their summit to their base, we experience all the varieties of heat and cold which are felt in every climate of the earth, at whatever season (D). There are many other mountainous countries in which we pass at once from a serene sky to dreadful

(C) This is the greatest height to which any person is known to have ascended in America: the greatest elevation which has been reached in the Alps is the top of Mont-Blanc, which is 2426 toises, and which Dr Paccard ascended on the 8th of August 1786. M. de Saussure arrived there likewise on the 3d of August 1787, accompanied by 17 persons.

(D) The more we are elevated above the surface of the earth, it becomes the colder; and accordingly the tops of the highest mountains are always covered with snow. At the height of about 2300 toises above the level of the sea no plant whatever is found to grow: and it appears from the observations of MM. de la Condamine, Bouguer, Godin, Dom George Juan, and Dom Antonio de Ulloa, the academicians sent to Quito in 1735, that at the height of 2434 the snow is perpetual, and never melts at any time of the year even under the equator. The congelation begins and continues in all the mountains of the Cordilleras at the same height above the level of the sea, which is determined by an equal elevation of the mercury in the barometer. But from experiments which have been made, Sir Isaac Newton concludes, that the density of the atmosphere at any height is as the weight of the incumbent air, that is, as the height of the mercury in the barometer; and consequently the density of the air is the same in the whole region of the atmosphere, where the congelation is continual, and where that perpetual cold commences which is felt on all mountains. Above this constant height the density of the air continues to diminish, and the cold becomes greater and greater till we

Mountain. dreadful ftorms and tempefts. It cannot therefore be doubted, that mountains have a great influence on the temperature of the countries to which they belong, by ftopping the courfe of certain winds, by forming barriers to the clouds, by reflecting the fun's rays, and by ferving as elevated conductors to the electricity of the atmofphere. It was formerly faid by travellers, that on the peak of Teneriffe they found that brandy loft its ftrength; that fpirit of wine became almoft infipid; that pepper, ginger, and falt, had little or no tafte when applied to the tongue; but, it was alleged, that Canary wines ftill retained their tafte on that mountain. Thefe ftories appeared too marvellous not to require new experiments; and M M. de Lamanon and Mongez, who vifited this peak in 1785, tell us, that the flavour and tafte of liquors appeared to have fuftained no lofs at that height: (See the experiments made on the Pic du Midi in the Pyrenees by M. Darcet, in the *Journal de Phyfique* for November 1776; and a journey to the peak of Teneriffe, in the fame *Journal* for Auguft 1785). At the foot, and fometimes at the middle, of thofe lofty mountains, the tops of which are always covered with fnow, we frequently find fprings which begin to run in May and dry up in September. When the fun approaches near enough to the tropic to warm the fummits of thefe mountains, the fnow with which they are covered melts, filtrates through their interior part, and iffues forth at their bafe. The only trees which grow on mountains of this kind are firs, pines, and other refinous trees; and the grafs becomes fhorter towards their fummit.

Mountains were not formed to be an ufelefs load upon the earth, but evidently anfwer very important purpofes; and we cannot enough admire their form and that kind of harmony which is difcernible in their arrangement. Some of them, vomiting out fire or fmoke, lava, and fulphur, indicate that they in fome meafure anfwer the purpofe of a chimney to fomething within the earth, which, if confined, would burft it in pieces: (See VOLCANO.) Of this kind are Mount Hecla in Iceland, Mount Etna in Sicily, Mount Vefuvius in the kingdom of Naples, Pichincha and Cotopaxi in America, &c. Others, the fummits of which reach into the clouds, attract and abforb the vapours of the fea, &c. which float in the air. It is obferved by M. l'Abbé Palaffon, that ftorms are moft frequent at the foot of thofe high mountains which form extenfive chains. Their enormous maffes, which feem to fupport the heavens on their fhoulders, arreft and fix the different meteors as they are formed. The clouds, in like manner, driven by the winds from different points of the horizon, there meet with impenetrable barriers, are there accumulated in great quantity, and remain fufpended on thefe bulwarks of the globe's furface, till the agitation of the atmofphere fucceeding the calm, produces ftorms, which are fo much the more terrible that they cannot expand and be difperfed but with great difficulty. They are commonly repelled from the mountains; and are then obferved to fpread over whole countries, to diffolve with peals of thunder, and to fall down in deftructive hail-fhowers fatal to the harveft and to the whole produce of the fields. This fcourge is peculiarly dreadful during the feafons of fpring and fummer, when a fufficient quantity of fnow remains on the mountains to cool the atmofphere. Mountain.

Some chains of mountains have openings; in others they are wanting: of the former kind are the ftraits of Thermopylæ, the Cafpian ftraits, the pafs of the Cordilleras, &c.

Thofe fpaces which feparate the tops of mountains are fo many bafons deftined for the reception of the condenfed mifts, and of the clouds precipitated into rain. The bowels of mountains appear to be great and inexhauftible refervoirs, and to contain fubterraneous canals and lateral openings formed by the hand of nature, that the feveral fpecies of animals may be fupplied with drink, that the earth may be fertilifed, and that nourifhment may be afforded for the growth of vegetables. The ftreams and rivers defcend from the ridges of mountains, the declivities of which form fo many inclined plains: Thus we find the Alps give rife to the Rhine, the Danube, the Rhone, and the Po. With regard to the wonderful ftructure, by means of which fo many advantages are obtained, fee the articles EARTH, SPRINGS, &c.

Mountains of the firft order form vaft folitudes and horrid deferts, where the habitations of men are not to be feen, and their footfteps are feldom to be traced. By their grandeur, their elevation, the variety of their pofitions, the fublime and awful exhibition of wonders which they contain, they elevate the mind and fire the imagination of the obferver. But thefe majeftic eminences have other advantages which deferve our attention. They form the common retreat of a multitude of wild beafts, which are fubfervient to our ufe: there the bear, the lynx, the ermine, the martin, the fox, and many other animals, the fkin of which we employ for furs, take up their abode; and thither the eagle and the vulture refort in fafety. Mountains likewife afford nourifhment to rein-deer, buffaloes, fallow-deer, roe-deer, and chamois; and they are vifited by birds of paffage which, under the guidance of inftinct, follow the fhorteft road to the place of their deftination. They produce medicinal plants, which almoft never grow elfewhere. In Swifferland they are alfo covered with deep forefts, which, by the great height of the trees, announce their antiquity. They afford both timber and fuel, and fupply the inhabitants with abundance of excellent pafture for their beftial during the whole fummer. The moft precious ftones, both for brilliancy and hardnefs, acquire their forms and colours in the fiffures of the rocks: the internal rents of mountains are filled and in a manner cemented by different metallic fubftances; while the grottos are furnifhed with numerous congelations, fhining

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we reach the fummits of the mountains, which prefent to our view all the horrors of winter as they are felt in the polar regions. But below this height, as the denfity of the air becomes greater in confequence of being conftantly preffed upon by a great fuperincumbent weight, the fun's heat increafes, fo that thofe who inhabit the plains at the foot of the mountain are expofed to all the inconveniences of the torrid zone.

Mountain. shining crystals, and substances of an extraordinary nature and figure. In short, every thing concurs to show, that the existence of mountains is absolutely necessary; and that in order to acquire a proper knowledge of them, they must be considered in many different points of view. Their position, their direction, their elevation, the extent of their base, their figure, their various external windings, their internal structure; in a word, every thing relating to the theory of the globe, and to the different temperatures of the atmosphere, must engage the observer's attention; and by studying and carefully examining the general constitution of mountains, the particular facts which they present to our view, their influence, their action on the atmosphere, the different substances of which they are composed, together with the arrangement and mixture of these substances, we may at length discover the true mechanism of the earth. The reader may consult the *Essais Sur l'etude des Montagnes; Journal de M. l'Abbé Rozier*, November 1773.

The difficulty and danger of ascending to the tops of mountains proceeds not from the thinness of the air, as has been commonly reported; but the reason is, that they rise with such a rugged and precipitate ascent, that they are utterly inaccessible. In some places they appear like a great wall of 600 or 700 feet high; in others, there stick out enormous rocks, that hang upon the brow of the steep, and every moment threaten destruction to the traveller below.

In this manner almost all the tops of the highest mountains are bare and pointed: and this naturally proceeds from their being so continually assaulted by thunders and tempests. All the earthy substances with which they might have been once covered, have for ages been washed away from their summits; and nothing is left remaining but immense rocks, which no tempest has hitherto been able to destroy.

Nevertheless, time is every day and every hour making depredations; and huge fragments are seen tumbling down the precipice, either loosened from the summit by the frost or rains, or struck down by lightning. Nothing can exhibit a more terrible picture than one of these enormous rocks, commonly larger than an house, falling from its height with a noise louder than thunder, and rolling down the side of the mountain. Dr Plot tells us of one in particular, which being loosened from its bed, tumbled down the precipice, and was partly shattered into a thousand pieces. Notwithstanding, one of the largest fragments of the same, still preserving its motion, travelled over the plain below, crossed a rivulet in the midst, and at last stopped on the other side of the bank! These fragments, as was said, are often struck off by lightning and sometimes undermined by rains; but the most usual manner in which they are disunited from the mountain is by frost: the rains insinuating between the interstices of the mountain, continue there until there comes a frost; and then, when converted into ice, the water swells with an irresistible force, and produces the same effect as gun-powder, splitting the most solid rocks, and thus shattering the summits of the mountain.

But not rocks alone, but whole mountains, are, by various causes, disunited from each other. We see, in many parts of the Alps, amazing clefts, the sides of which so exactly correspond with the opposite, that no doubt can be entertained of their having been once joined together. At Cajeta in Italy, a mountain was split in this manner by an earthquake; and there is a passage opened through it, that appears as if elaborately done by the industry of man. In the Andes these breaches are frequently seen. That at Thermopylæ in Greece has been long famous. The mountain of the Troglodytes in Arabia has thus a passage through it; and that in Savoy, which nature began and which Victor Amadeus completed, is an instance of the same kind.

We have accounts of some of these disruptions immediately after their happening. "In the month of June, in the year 1714, a part of the mountain of Diableret, in the district of Valais in France, suddenly fell down, between two and three o'clock in the afternoon, the weather being very calm and serene. It was of a conical figure, and destroyed 55 cottages in the fall. Fifteen persons, together with about 100 beasts, were also crushed beneath its ruins, which covered an extent of a good league square. The dust it occasioned instantly covered all the neighbourhood in darkness. The heaps of rubbish were more than 300 feet high. They stopped the current of a river that ran along the plain, which now is formed into several new and deep lakes. There appeared, through the whole of this rubbish, none of those substances that seemed to indicate that this disruption had been made by means of subterraneous fires. Most probably, the base of this rocky mountain was rotted and decayed; and thus fell, without any extraneous violence." In the same manner, in the year 1618, the town of Pleurs in France was buried beneath a rocky mountain, at the foot of which it was situated.

These accidents, and many more that might be enumerated of the same kind, have been produced by various causes: by earthquakes, as in the mountain at Cajeta; or by being decayed at the bottom, as at Diableret. But the most general way is, by the foundation of one part of the mountain being hollowed by waters, and, thus wanting a support, breaking from the other. Thus it generally has been found in the great chasms in the Alps; and thus it almost always is known in those disruptions of hills which are known by the name of *land-slips*. These are nothing more than the sliding down of an higher piece of ground, disrooted from its situation by subterraneous inundations, and settling itself upon the plain below.

There is not an appearance in all nature that so much astonished our ancestors as these land-slips. In fact, to behold a large upland, with its houses, its corn, and cattle, at once loosened from its place, and floating as it were upon the subjacent water; to behold it quitting its ancient situation, and travelling forward like a ship, in quest of new adventures; this is certainly one of the most extraordinary appearances that can be imagined; and, to a people ignorant of the powers of nature, might well be considered as a prodigy. Accordingly, we find all our old historians mentioning it as an omen of approaching calamities. In this more enlightened age, however, its cause is very well known; and, instead of exciting ominous apprehensions in the populace, it only gives rise to some

Mountain. some very ridiculous law-suits among them, about whose the property shall be; whether the land which has thus slipt shall belong to the original possessor or to him upon whose grounds it has encroached and settled. What has been the determination of the judges is not so well known; but the circumstances of the slips themselves have been minutely enough and exactly described.

In the lands of Slatberg, in the kingdom of Ireland, there stood a declivity gradually ascending for near half a mile. In the year 1713, and on the 10th of March, the inhabitants perceived a crack on its side, somewhat like a furrow made with a plough, which they imputed to the effects of lightning, as there had been thunder the night before. However, on the evening of the same day, they were surprised to hear an hideous confused noise issuing all round from the side of the hill; and their curiosity being raised, they resorted to the place. There, to their amazement, they found the earth for near five acres all in gentle motion, and sliding down the hill upon the subjacent plain. This motion continued the remaining part of the day and the whole night: nor did the noise cease during the whole time; proceeding, probably, from the attrition of the ground beneath. The day following, however, this strange journey down the hill ceased entirely; and above an acre of the meadow below was found covered with what before composed a part of the declivity.

However, these slips, when a whole mountain's side seems to descend, happen but very rarely. There are some of another kind, however, much more common; and, as they are always sudden, much more dangerous. These are snow-slips, well-known, and greatly dreaded by travellers. It often happens, that when snow has long been accumulated on the tops and on the sides of mountains, it is borne down the precipice either by means of tempests or its own melting. At first, when loosened, the volume in motion is but small: but it gathers as it continues to roll; and by the time it has reached the habitable parts of the mountain, it is generally grown of enormous bulk. Wherever it rolls, it levels all things in its way, or buries them in unavoidable destruction. Instead of rolling, it sometimes is found to slide along from the top; yet even thus it is generally as fatal as before. Nevertheless, we have had an instance, a few years ago, of a small family in Germany that lived for above a fortnight beneath one of these snow-slips. Although they were buried during that whole time in utter darkness, and under a bed of some hundred feet deep, yet they were luckily taken out alive, the weight of the snow being supported by a beam that kept up the roof, and nourishment supplied them by the milk of a she-goat that was buried under the same ruin.

Attraction of Mountains. This is a late discovery, and a very considerable confirmation of Sir Isaac Newton's theory of universal gravity. According to the Newtonian system, an attractive power is not only exerted between those large masses of matter which constitute the sun and planets, but likewise between all comparatively smaller bodies, and even between the smallest particles of which they are composed. Agreeably to this hypothesis, a heavy body, which ought to gravitate or tend toward the centre of the earth, in a direction perpendicular to its surface, supposing the said surface to be perfectly even and spherical, ought likewise, though in a less degree, to be attracted and tend towards a mountain placed on the earth's surface; so that a plumb-line, for instance, of a quadrant, hanging in the neighbourhood of such a mountain, ought to be drawn from a perpendicular situation, in consequence of the attractive power of the quantity of matter of which it is composed acting in a direction different from that exerted by the whole mass of matter in the earth, and with a proportionably inferior degree of force. Mountain.

Though Sir Isaac Newton had long ago hinted at an experiment of this kind, and had remarked, that "a mountain of an hemispherical figure, three miles high and six broad, would not, by its attraction, draw the plumb-line two minutes out of the perpendicular (E):" yet no attempt to ascertain this matter by actual experiment was made till about the year 1738; when the French academicians, particularly Messrs Bouguer and Condamine, who were sent to Peru to measure a degree under the equator, attempted to discover the attractive power of Chimboraço, a mountain in the province of Quito. According to their observations, which were however made under circumstances by no means favourable to an accurate solution of so nice and difficult a problem, the mountain Chimboraço exerted an attraction equal to eight seconds. Though this experiment was not perhaps sufficient to prove satisfactorily even the reality of an attraction, much less the precise quantity of it; yet it does not appear that any steps had been since taken to repeat it.

Through the munificence of his Britannic majesty, the royal society were enabled to undertake the execution of this delicate and important experiment; the astronomer-royal was chosen to conduct it. After various inquiries, the mountain Schehallien, situated nearly in the centre of Scotland, was pitched upon as the most proper for the purpose that could be found in this island. The observations were made by taking the meridian zenith distances of different fixed stars, near the zenith, by means of a zenith sector of ten feet radius; first on the south, and afterwards on the north side of the hill, the greatest length of which extended in an east and west direction.

It is evident, that if the mass of matter in the hill exerted any sensible attraction, it would cause the plumb-line of the sector, through which an observer viewed a star in the meridian, to deviate from its perpendicular situation, and would attract it contrarywise at the two stations, thereby doubling the effect. On the south side the plummet would be drawn to the northward, by the attractive power of the hill placed to the northward of it: and on the north side, a contrary and equal deflection of the plumb-line would take

(E) By a very easy calculation it is found that such a mountain would attract the plumb-line 1′ 18″ from the perpendicular.

Mountain. take place, in confequence of the attraction of the hill, now to the fouthward of it. The apparent zenith diftances of the ftars would be affected contrarywife; thofe being increafed at the one ftation which were diminifhed at the other: and the correfpondent quantities of the deflection of the plumb-lime would give the obferver the fum of the contrary attractions of the hill, acting on the plummet at the two ftations; the half of which will of courfe indicate the attractive power of the hill.

The various operations requifite for this experiment lafted about four months; and from them it appears, that the fum of the two contrary attractions of the mountain Schehallien, in the two temporary obfervations which were fucceffively fixed half-way up the hill (where the effect of its attraction would be greateft), was equal to 11″. 6.—From a rough computation, founded on the known law of gravitation, and on an affumption that the denfity of the hill is equal to the mean denfity of the earth, it appears that the attraction of the hill fhould amount to about the double of this quantity. From thence it was inferred, that the denfity of the hill is only about half the mean denfity of the earth. It does not appear, however, that the mountain Schehallien has ever been a volcano, or is hollow; as it is extremely folid and denfe, and feemingly compofed of an entire rock.

The inference drawn from thefe experiments may be reduced to the following:

"1. It appears, that the mountain Schehallien exerts a fenfible attraction; therefore, from the rules of philofophifing, we are to conclude, that every mountain, and indeed every particle of the earth, is endued with the fame property, in proportion to its quantity of matter.

"2. The law of the variation of this force, in the inverfe ratio of the fquares of the diftances, as laid down by Sir Ifaac Newton, is alfo confirmed by this experiment. For if the force of attraction of the hill had been only to that of the earth as the matter in the hill to that of the earth, and had not been greatly increafed by the near approach to its centre, the attraction thereof muft have been wholly infenfible. But now, by only fuppofing the mean denfity of the earth to be double to that of the hill, which feems very probable from other confiderations, the attraction of the hill will be reconciled to the general law of the variation of attraction in the inverfe duplicate ratio of the diftances, as deduced by Sir Ifaac Newton from the comparifon of the motion of the heavenly bodies with the force of gravity at the furface of the earth; and the analogy of nature will be preferved.

"3. We may now, therefore, be allowed to admit this law, and to acknowledge, that the mean denfity of the earth is at leaft double of that at the furface; and confequently that the denfity of the internal parts of the earth is much greater than near the furface. Hence alfo, the whole quantity of matter in the earth will be at leaft as great again as if it had been all compofed of matter of the fame denfity with that at the furface; or will be about four or five times as great as if it were all compofed of water.—This conclufion, Mr Mafkelyne adds, is totally contrary to the hypothefis of fome naturalifts, who 'fuppofe the earth to be only a great hollow fhell of matter; fupporting itfelf from the property of an arch, with an immenfe vacuity in the midft of it.' But, were that the cafe, the attraction of mountains, and even fmaller inequalities in the earth's furface, would be very great, contrary to experiment, and would affect the meafures of the degrees of the meridian much more than we find they do; and the variation of gravity, in different latitudes, in going from the equator to the poles, as found by pendulums, would not be near fo regular as it has been found by experiment to be. Mountain.

"4. As mountains are by thefe experiments found capable of producing fenfible deflections of the plumb-lines of aftronomical inftruments; it becomes a matter of great importance, in the menfuration of degrees in the meridian, either to choofe places where the irregular attractions of the elevated parts may be fmall; or where, by their fituation, they may compenfate or counteract the effects of each other."

For meafuring the heights of mountains, fee the article BAROMETER.

Burning MOUNTAINS. See ÆTNA, HECLA, VESUVIUS, and VOLCANO.

Marble MOUNTAINS. Of thefe there are great numbers in Egypt, from which, though immenfe quantities have been carried off for the multitude of great works erected by the ancient Egyptians; yet, in the opinion of Mr Bruce who paffed by them in his journey to Abyffinia, there is ftill fuch an abundant fupply, that it would be fufficient to build Rome, Athens, Corinth, Syracufe, Memphis, Alexandria, and half a dozen more of fuch cities.

The firft mountain of this kind mentioned by Mr Bruce is one oppofite to Terfowey, confifting partly of green marble, partly of granite, with a red blufh upon a grey ground, and fquare oblong fpots. Here he faw a monftrous obelifk of marble, very nearly fquare, broken at the end, and nearly 30 feet long and 19 feet in the face. Throughout the plain there were fcattered fmall pieces of jafper, with green, white, and red fpots, called in Italy *diafpro fanguineo*; and all the mountains upon that fide feemed to confift of the fame materials. Here alfo were quantities of fmall pieces of granite of various kinds, as well as porphyry, which had been carried down by a torrent, probably from the ancient quarries. Thefe pieces were white mixed with black fpots, and red with green veins and black fpots. All the other mountains on the right hand were of red marble, but no great beauty; thofe on the oppofite fide being green marble, probably of the ferpentine kind. This, he fays, was one of the moft extraordinary fights he ever faw. The former mountains were of a confiderable height, without a tree, fhrub, or blade of grafs upon them; and this looked exactly as if it had been covered over with Havannah and Brazil fnuff. Proceeding farther on, he entered another defile with mountains of green marble on every fide. The higheft he faw appeared to be compofed of ferpentine marble; having a large vein of green jafper fpotted with red running through about one-third of its thicknefs. It was extremely hard; fo that it did not yield to the blows of a hammer, though it was evident that it had formerly been quarried; and there were channels for bringing water, which terminated

nated in this quarry of jasper; "a proof (says Mr Bruce) that water was one of the means used in cutting those hard stones."

On these mountains, our author observes, that "the porphyry shows itself by a fine purple sand without any gloss upon it, though the colour is very agreeable to the eye. It is mixed with the white sand and fixed marble of the plains. Green and unvariegated marble is also found in the same mountain with the porphyry. The marble is brittle for some inches where the two veins meet; but the porphyry is as hard as in other places. The granite appears like a dirty brown stone covered with sand; but this is only the change made upon it by the sun and weather; for on breaking it, the colour appears to be grey with black spots, and a reddish cast on the surface. The reddish colour appears to be impaired by exposure to the atmosphere; but is recovered upon polishing it anew. It is in greater quantity than the porphyry, and nearer to the Red Sea. The granite is next to the porphyry, but never joined with it in the same mountain. Being covered with a reddish sand, it looks as if the whole mountain were covered with brick-dust." There is likewise a kind of red marble with white veins, which our author has seen at Rome and likewise in Britain. The common green, called *serpentine*, looks as if it were covered with Brazil snuff. Along with this green he saw two samples of the beautiful kind called *Isabella;* one of them with the yellowish cast of Quaker-colour, the other of that bluish cast called *dove-colour;* and these two seemed to divide the mountains with the serpentine. Here also he saw the vein of jasper; but had not time to determine whether it was the same with that called bloody-jasper or blood-stone or not.

The marble of greatest value, however, is that called *Verde Antico*, which is of a dark-green colour with white spots. It is found, like the jasper, in the mountains of the plain green serpentine, and is not discoverable by the dust or any particular colour upon it. "First (says Mr Bruce) there is a blue flaky stone exceedingly even and smooth in the grain, solid, and without sparks and colour. When broken it is something lighter than a slate, and more beautiful than most kinds of marble; it is like the lava of volcanoes when polished. After lifting this we come to the beds of verde antico; and here the quarrying is very obvious; for it has been uncovered in patches not above 20 feet square. Then, in another part, the green stone has been removed and another pit wrought." In other places of the plain he saw pieces of African marble, but no rocks or mountains of it. He supposes it to be found in the heart of some other coloured marble, and in strata like the jasper and verde antico; and, as he suspects, in the mountains of Isabella marble, especially of the yellowest sort. This vast store of marble is placed on a ridge, whence there is a descent to the east and west, so that it could be conveyed either to the Nile or the Red Sea. The level ground and hard fixed gravel are proper for the heaviest carriages; so that any weight whatever might easily be conveyed to the place of embarkation. In the more distant mountains also he observed the same care taken to facilitate the carriage: for the defiles between those mountains he supposes not to be natural but artificial openings; and he observed the roads from them to the Nile to be cut with a descent of about one foot in 50 at most; so that, all the way down, the carriages must have moved with as little draught as possible, at the same time that the vast friction would prevent any undue acceleration; to which also some other means must have contributed: But thus, he thinks, it may be explained how such immense blocks might have been removed as were employed in the ancient Egyptian works.

Mountains of marble and porphyry are not peculiar to Egypt, for they are likewise to be met with in the north of Scotland; and in the Western Isles there are likewise such quantities of these materials to be met with, as, in the opinion of Mr Williams, would be sufficient to serve all Europe.

Written MOUNTAIN, *Mountain of Inscriptions*, or *Jibel-al-Mokatteb*, a supposed mountain, or chain of mountains, in the wilderness of Sinai; on which, for a great extent of space, the marble of which the mountain consists is inscribed with innumerable characters, reaching from the ground sometimes to the height of 12 or 14 feet. These were mentioned by a Greek author in the third century, and some of them have been copied by Pococke and other late travellers; notwithstanding which, there is still a very great uncertainty even of the *existence* of such mountain or mountains. The vast number of these inscriptions, the desart place in which they are found, and the length of time requisite for executing the task, has induced a notion by no means unnatural, that they are the work of the Israelites during their forty years wandering in the wilderness. Others are of opinion that they contain nothing of any importance, but consist merely of the names of travellers and the dates of their journeys.

M. Niebuhr, who visited this country about 30 years ago, made every attempt in his power, though without success, to obtain a sight of this celebrated mountain. On applying to some Greeks at Suez, they all declared that they knew nothing of the written mountain: they, however, directed him to an Arabian sheik, who had passed all his lifetime in travelling between Suez and Mount Sinai; but he knew no more of it than the former. Understanding, however, that a considerable reward would be given to any person who would conduct them thither, this Arab directed them to another; who pretended not only to know that mountain, but all others upon which there were any inscriptions throughout the desart. On inquiring particularly, however, our travellers found that he was not to be depended upon; so that they were obliged to have recourse to a fourth sheik, who by his conversation convinced them that he had seen mountains with inscriptions in unknown characters upon them. It does not appear, however, that this person was very capable, more than the rest, of leading them to the place they so much wished for; though he conducted them to some rocks upon which there were inscriptions in unknown characters. They are most numerous in a narrow pass between two mountains named *Om-er-ridstein;* and, says M. Niebuhr, "the pretended Jebel-el-Mokatteb may possibly be in its neighbourhood." Some of these inscriptions were copied by our author; but he does not look upon them to be

Mountain. of any confequence. "They feem (fays he) to have been executed at idle hours by travellers, who were fatisfied with cutting the unpolifhed rock with any pointed inftrument, adding to their names and the date of their journeys fome rude figures, which befpeak the hand of a people but little fkilled in the arts. When fuch infcriptions are executed with the defign of tranfmitting to pofterity the memory of fuch events as might afford inftructive leffons, greater care is generally taken in the preparation of the ftones, and the infcriptions are engraven with more regularity."

When M. Niebuhr arrived at laft at the mountain to which the fheik had promifed to conduct him, he did not find there any infcriptions; but on climbing up to the top, he found nothing there but an Egyptian cemetery, the ftones of which were covered with hieroglyphics. The tomb-ftones are from five to feven feet in length, fome ftanding on end and others lying flat; and "the more carefully they are examined (fays he), the more certainly do they appear to be fepulchral ftones, having epitaphs infcribed on them. In the middle of thefe ftones is a building, of which only the walls now remain; and within it are likewife a great many of the fepulchral ftones. At one end of the building feems to have been a fmall chamber, of which the roof ftill remains. It is fupported upon fquare pillars; and thefe, as well as the walls of the chamber, are covered with hieroglyphic infcriptions. Thro' the whole building are various bufts executed in the manner of the ancient Egyptians. The fepulchral ftones and the bufts are of hard and fine-grained fand-ftone." M. Niebuhr is of opinion that this cemetery was not the work of the Egyptians themfelves, but of fome colony which came from Egypt, and had adopted the manners and cuftoms of the people. He fuppofes that it might have been built by the Arabs who had conquered Egypt under the fhepherd kings and adopted the Egyptian manners during their refidence there. As it muft have belonged to an opulent city, however, he owns that there is a great difficulty in accounting for the exiftence of fuch a city in the midft of a defart.

The tranflator of Volney's travels afcribes thefe infcriptions to the pilgrims which vifit Mount Sinai. But to this, as well as to every other conjecture, there is this objection, that whether the infcriptions be well executed or not, whether they contain matters of importance or not, they ought to have been written in a language which *fomebody* could underftand; but from the copies that have been taken of them by Dr Pococke and others, it does not appear that they could be explained either by him or any other perfon.

When Dr Clayton, bifhop of Clogher, vifited this part of the world about the year 1723, he expreffed the greateft defire to have the matter concerning this written mountain or mountains afcertained, and even made an offer of L. 500 Sterling to any literary perfon who would undertake the journey and endeavour to decypher the infcriptions; but no fuch perfon has appeared, and the exiftence of the mountains is teftified only by the fuperior of a convent at Cairo, who gave that mentioned in the beginning of this article. Until that part of the world, therefore, become more acceffible to travellers, there is but little hope that we can come to any certainty in the matter. M. Niebuhr plainly, from his own accounts, had not influence enough with the Arabs to fhow him almoft any thing, as they refufed to conduct him even to the fummit of Mount Sinai.

White Mountains. See *New Hampshire.*

Mountains of the Moon, a chain of mountains in Africa, extending themfelves between Abyffinia and Monomotapa, and receiving the above denomination from their great height.

Mountains of the Lions, alfo in Africa, divide Nigritia from Guinea, and extend as far as Ethiopia. They were ftyled by the ancients *the mountains of God,* on account of their being greatly fubject to thunder and lightning.

Mountain of Forty-days; a mountain of Judea, fituated in the plain of Jericho to the north of that city. According to the Abbe Mariti's defcription, the fummit of it is covered neither with fhrubs, turf, nor earth; it confifts of a folid mafs of white marble, the furface of which is become yellow by the injuries of the air. "The path by which you afcend to it (fays our author) fills one with terror, as it rifes with a winding courfe between two abyffes, which the eye dares fcarcely behold. This path is at firft pretty broad, but it at length becomes fo confined, that one can with difficulty place both feet upon it at the fame time. When we had afcended a little higher, we found an Arab ftretched out on the path, who made us pay a certain toll for our paffage. Here the traveller requires courage. One of the parapets of the path being broke, we clung to the part which remained until we had reached a fmall grotto, fituated very commodioufly, as it gave us an opportunity of recovering our breath. When we had refted ourfelves a little, we purfued our courfe, which became ftill more dangerous. Sufpended almoft from the rock, and having before our eyes all the horror of the precipice, we could advance only by dragging one foot after the other; fo that had the fmalleft fragment given way under us, we fhould have been hurried to the bottom of this frightful abyfs.

"Proceeding a little farther, we found a fecond grotto, the entrance of which was about nine feet in breadth. It would be of confiderable fize, were not about two-thirds of it filled up by part of the roof, which had tumbled down. This grotto conducts to another, which we had the curiofity to enter, but we were almoft ftifled by the great number of bats which were fluttering up and down in it. Being defirous of retreating almoft as foon as we had entered, they flew in fuch numbers around us, that they in a manner covered our whole bodies; but they luckily made a paffage for themfelves, and fuffered us to breathe with freedom. By the glimmering light which reached this grotto, we perceived that the bottom of it was covered to the height of a hand-breadth with the excrements of thefe animals; and we remarked fome niches in the fides of it, which gave us reafon to conclude, that it had once ferved as a fepulchre to the ancient anchorets. This is the more probable, as the other grotto appears by the remains of an altar and of fome Greek paintings to have been formerly a church. In the right corner there is a large ciftern, the plafter of which retains its original folidity, though

 broken

Mountain, Mourning.

broken in a few places. In the left corner there is a ſmall ſtair which conducts to a third grotto. This is much longer and broader than any of the former, and its walls are ornamented alſo with Greek paintings, which repreſent the twelve apoſtles in their natural ſize. Their figures, however, are ſo much changed, that one could ſcarcely diſtinguiſh who they are, were it not that their names are written in Greek characters upon the glory which ſurrounds their heads.—At the farther end of this grotto ſtands a ſquare altar a little damaged; above which is an oval painting of the Annunciation, in perfect preſervation. The chiſel has been employed to render theſe grottos regular and ſmooth; and it appears that they were inhabited by a certain number of hermits, who devoted themſelves to a life of contemplation. No writer has been able to tell us who the founder of this hermitage was.—Nicephorus and Euſebius, who have deſcribed all the churches and religious places of Paleſtine and Judea, do not ſpeak of theſe chapels.

"This mountain is one of the higheſt in the province, and one of its moſt ſacred places. It takes its name from the rigorous faſt which Chriſt obſerved here after having triumphed over the vanities of the world and the power of hell. In remembrance of this miracle, a chapel was formerly conſtructed on the ſummit of the mountain. It may be ſeen from the plain, but we could not approach it, as the path was almoſt entirely deſtroyed. It, however, may be acceſſible on the other ſide of the mountain, which we did not viſit. A great many ſcattered grottos are ſeen here; in one of which, according to Quareſmius, were depoſited the bodies of ſeveral anchorets, which are ſtill entire. I have heard the ſame thing aſſerted in the country, but I could never meet with any perſon who had ſeen them. Here we enjoyed the moſt beautiful proſpect imaginable. This part of the Mountain of Forty Days overlooks the mountains of Arabia, the country of Gilead, the country of the Ammonites, the plains of Moab, the plain of Jericho, the river Jordan, and the whole extent of the Dead Sea. It was here that the devil ſaid to the Son of God, 'All theſe kingdoms will I give thee, if thou wilt fall down and worſhip me."

MOURNING, a particular dreſs or habit worn to ſignify grief on ſome melancholy occaſion, particularly the death of friends or of great public characters — The modes of mourning are various in various countries; as alſo are the colours that obtain for that end. In Europe, the ordinary colour for mourning is black; in China, it is white; in Turkey, blue or violet; in Egypt, yellow; in Ethiopia, brown. White obtained formerly in Caſtile on the death of their princes. Herrera obſerves, that the laſt time it was uſed was in 1498, at the death of prince John. Each people pretend to have their reaſons for the particular colour of their mourning: white is ſuppoſed to denote purity; yellow, that death is the end of human hopes, in regard that leaves when they fall, and flowers when they fade, become yellow: brown denotes the earth, whither the dead return; black, the privation of life, as being the privation of light: blue expreſſes the happineſs which it is hoped the deceaſed does enjoy; and purple or violet, ſorrow on the one ſide, and hope on the other, as being a mixture of black and blue.

Mourning.

MOURNING, among the ancients, was expreſſed various ways.

Amongſt the Jews, on the death of their relations or intimate friends, grief or mourning was ſignified by weeping, tearing their clothes, ſmiting their breaſts, or tearing them with their nails, pulling or cutting off their hair and beards, walking ſoftly, *i. e.* bare-foot, lying upon the ground, faſting, or eating upon the ground. They kept themſelves cloſe ſhut up in their houſes, covered their faces, and abſtained from all work, even reading the law, and ſaying their uſual prayers. They neither dreſſed themſelves, nor made their beds, nor ſhaved themſelves, nor cut their nails, nor went into the bath, nor ſaluted any body: ſo that ſulkineſs ſeems to have been an indication of ſorrow; and dirtineſs, of diſtreſs. The time of mourning among the Jews was generally ſeven days: tho' this was lengthened or ſhortened according to circumſtances; but 30 days were thought ſufficient upon the ſevereſt occaſions. The different periods of the time of mourning required different degrees of grief, and different tokens of it.

The Greeks, on the death of friends, ſhowed their ſorrow by ſecluding themſelves from all gaiety, entertainments, games, public ſolemnities, the enjoyment of wine, and the delights of muſic. They ſat in gloomy and ſolitary places, ſtripped themſelves of all external ornaments, put on a coarſe black ſtuff by way of mourning, tore their hair, ſhaved their heads, rolled themſelves in the duſt and mire, ſprinkled aſhes on their heads, ſmote their breaſts with their palms, tore their faces, and frequently cried out with a lamentable voice and drawling tone, reiterating the interjection ε, ε, ε, ε; hence funeral lamentations were called Ελεγοι. If they appeared in public during the time of mourning, they had a veil thrown over their faces and heads. During the funeral proceſſion, certain perſons called εξαρχοι θρηνων marched before, and ſung melancholy ſtrains called ολοφυρμοι Ιαλεμοι, Λινοι and Αιλινοι. Theſe vocal mourners ſung thrice during the proceſſion round the pile and round the grave. Flutes were alſo uſed to heighten the ſolemnity. At the funerals of ſoldiers, their fellow-ſoldiers who attended, as a teſtimony of their affliction held their ſhields, their ſpears, and the reſt of their armour, inverted.

As to the tokens of private grief among the Romans, they were the ſame as thoſe already obſerved as cuſtomary amongſt the Greeks. Black or dark-brown were the colours of the mourning habits worn by the men; they were alſo common to the women. The mourning of the emperors at firſt was black. In the time of Auguſtus, the women wore white veils, and the reſt of their dreſs black. From the time of Domitian they wore nothing but white habits, without any ornaments of gold, jewels, or pearls. The men let their hair and beards grow, and wore no wreaths of flowers on their heads while the days of mourning continued. The longeſt time of mourning was ten months: this was Numa's eſtabliſhment, and took in his whole year. For a widow to marry during this time was infamous. Mourning was not uſed for children who died under three years of age. From this age to ten they mourned as many months as the child was years old. A remarkable victory, or other happy event, occaſioned the ſhortening of the time of mourning:

ing: The birth of a child, or the attainment of any remarkable honour in the family, certain feafts in honour of the gods, or the confecration of a temple, had the fame effect. After the battle at Cannæ, the commonwealth decreed that mourning fhould not be worn for more than 30 days, that the lofs might be forgot as foon as poffible. When public magiftrates died, or perfons of great note, alfo when any remarkable calamity happened, all public meetings were intermitted, the fchools of exercife, baths, fhops, temples, and all places of concourfe, were fhut up, and the whole city put on a face of forrow; the fenators laid afide the *laticlave*, and the confuls fat in a lower feat than ordinary. This was the cuftom of Athens alfo, and was obferved upon the death of Socrates not long after he had been fentenced to death by their judges.

Præficæ, or mourning women, (by the Greeks called θρηνων εξαρχοι), went about the ftreets: this was cuftomary among the Jews as well as the Greeks and Romans, (Jerem. ix. 17.)

MOUSE, in zoology. See Mus.

Mouse-Ear, in botany. See Hieracium.

Mouse-Tail. See Myosurus.

Dor-Mouse. See Myoxus.

Shrew-Mouse. See Sorex.

MOUSELLE, the name of an Eaft Indian tree, with white tubular flowers, which fall off every day in great plenty. They are of a fweet agreeable fmell, and the Gentoos are very fond of wearing them, ftringing and hanging them about their necks and arms. The fruit is a pale-red cherry, of the fhape and fize of our white heart-cherry, but the foot-ftalk is not quite fo long. This fruit has a ftone in it, containing a bitter oily kernel. The Indians rub with this oil any part ftung by a fcorpion or bitten by a centipede, which it foon cures. The crows are very fond of the fruit.

MOUSUL, or Mosul, a large city of Turkey in Afia, and capital of a Beglerbegate, ftands on the weft bank of the Tigris, in the latitude, according to Mr Ives's obfervation, of 36° 30'. It is furrounded with ftone-walls, but has many of its ftreets lying wafte. Tavernier fpeaks of it as a ruined place, with only two blind markets and a forry caftle; yet, he fays, that it is much frequented by merchants, and that its bafha commands 3000 men. There is a bridge of boats over the Tigris; and the city is a thoroughfare from Perfia to Syria, which makes it a place of trade, and which is more augmented by a conftant traffic from this place to Bagdad. The country on this fide the river is fandy and barren; but over againft it is exceedingly fruitful, and yields very good crops of corn and fruit in abundance. Mr Ives fays, it was the beft built city he had feen in Turkey; but had nothing in it to attract the notice of an European. It was befieged for near fix months by Nadir Shah without fuccefs. Breaches were frequently made in the walls, and affaults continued for three days fucceffively; but the affailants were conftantly repulfed, and the breaches made in the day-time repaired during the night. The befieged had unanimoufly refolved to die rather than to fubmit. The Turks declared, that fhould the place be forced to furrender, they were determined to put to death all their wives and daughters firft, that they might not fall into the vile hands of the abhorred Perfians. The place was therefore defended with uncommon bravery; even the women and children exerted themfelves with the greateft alacrity. The Chriftians behaved in fuch a manner as to gain the efteem and admiration of the other inhabitants; and fome of their churches being demolifhed, they were afterwards repaired at the expence of government.

In this city there are a great many mofques, the largeft and moft ftately of which is ornamented on the top with green tiles. At the doors of thefe houfes there are ufually infcriptions in gilt letters, declaring the awfulnefs of the building, as being the houfe of God. One of them has a minaret which bends like thofe of Bagdad. Some of the moft bigotted Turks fay, that Mahomet faluted this minaret as he paffed; on which it bent its head in reverence to the prophet, and ever after continued in that fituation. The manufacture of this city is *muffolen* (muflin), which is made very ftrong and pretty fine. In the year 1757 this city and the country adjacent was vifited by a dreadful famine, owing to the preceding hard winter, and innumerable multitudes of locufts, by which the fruits of the earth were deftroyed. When Mr Ives was there in 1758, the country was comparatively depopulated. Almoft all the brute creation had been deftroyed for the fubfiftence of man. During the famine, the people had eaten dogs, and every kind of animal which is held in abhorrence at any other time, not fparing even their own children; and the dead bodies lay in the ftreets for want of people to bury them. Their fruit-trees were alfo deftroyed by the froft; fo that when our author was there fcarce any fruit could be had. The neighbouring mountains afford filver mines; and they would yield much quickfilver if the Turks had either the fkill or inclination to work them to advantage. Lanza fays, that fome time ago an Englifhman who travelled through thefe parts got two or three bottles of it, which he prefented to the bafha as a fpecimen of what might be done in that way: but no farther attempt was made. Here alfo are fome lead mines, which fupply as much of that metal as furnifhes them with bullets and fome neceffary utenfils.

MOU-TAN, or peony-shrub of China: alfo called *hoa-ouang*, or "the king of flowers;" and *peleang-kin*, "an hundred ounces of gold," in allufion to the exceffive price given formerly by fome of the virtuofi for certain fpecies of this plant. The mou-tan feems to claim pre-eminence, not only on account of the fplendor and number of its flowers, and of the fweet odour which they diffufe around, but alfo on account of the multitude of leaves which compofe them, and of the beautiful golden fpots with which they are interfperfed. This plant, which is of a fhrubby nature, fhoots forth a number of branches, which form a top almoft as large as thofe of the fineft orange-trees that are planted in boxes. Some of the mou-tan have been feen eight or ten feet in height. The reafon why few are raifed at prefent to this fize is, becaufe their flowers are lefs beautiful, and their branches being too weak, cannot fuftain their weight. The root of the mou-tan is long and fibrous, of a pale yellow colour, and covered with a greyifh or reddifh rind. Its leaves are deeply indented, and of a much darker green above than below. Its flowers, which are compofed of num-

Mou-tan, Mouth. berlefs petals, blow like a rofe, and are fupported by a calyx compofed of four leaves. From the bottoms of the petals arife feveral ftamina without any order, which bear on their tops fmall antheræ, of a beautiful golden colour. The fruit bend downwards like thofe of common peony, burft when they become dry, and fhed their feeds.

Grofier's Hift. of China. There are three kinds of mou-tan; common mou-tan, dwarf mou-tan, and the mou-tan tree. The laft fpecies feems at prefent to be loft; fome of them were formerly feen which were 25 feet in height. Dwarf mou-tan is little efteemed: a few plants of this kind are only cultivated to preferve the fpecies. Common mou-tan, which has always been highly prized by florifts, is more generally difperfed. It is raifed like an efpalier in form of a fan, bufh, or orange-tree. Some of them flower in fpring, others in fummer, and fome in autumn. Thefe different fpecies muft each be cultivated in a different manner.

The vernal and fummer mou-tan are thofe that are cultivated in greateft number; thofe of autumn require too flavifh an attention during the great heat of the dog-days. The mou-tan of each feafon are divided into fingle and double; the former are fubdivided into thofe of 100 leaves and 1000 leaves; the fecond have a large calyx filled with ftamina, that bear on their tops gold-coloured antheræ. Thefe are the only kind that produce feed. The flowers of both appear under the different forms of a bafon, pomegranate, marigold, &c. Some of the mou-tan are red, others violet, purple, yellow, white, black, and blue; and thefe colours, varied by as many fhades, produce a prodigious number of different kinds. We are affured, that the Chinefe florifts have the fecret of changing the colour of their mou-tan, and of giving them whatever tints they pleafe; but they cannot effect this change but upon thofe plants which have never produced flowers.

A mou-tan, to pleafe the eye of a Chinefe florift, muft have a rough crooked ftalk, full of knots, and of a blackifh-green colour; its branches muft crofs one another, and be twifted in a thoufand fantaftical figures; the fhoots that proceed from them muft be of a delicate green fhaded with red; the leaves muft be large, of a beautiful green, very thick, and fupported by reddifh ftalks; its flowers muft blow at different times, in form of a tuft, be all of the fame colour, and ftand erect upon their ftems; they muft alfo be feven or eight inches in diameter, and exhale a fweet and agreeable odour.

MOUTH, in anatomy, a part of the face, confifting of the lips, the gums, the infides of the cheeks, the palate, the falival glands, the os hyoides, the uvula, and the tonfils, which fee under the article ANATOMY.

Mr Derham obferves, that the mouth in the feveral fpecies of animals is nicely adapted to the ufes of fuch a part, and well fized and fhaped for the formation of fpeech, the gathering and receiving of food, the catching of prey, &c. In fome creatures it is wide and large, in others little and narrow; in fome it is formed with a deep incifure into the head, for the better catching and holding of prey, and more eafy commination of hard, large, and troublefome food; and in others with a fhorter incifure, for the gathering and holding of herbaceous food. In birds it is neatly fhaped for piercing the air; hard and horny, to fupply the want of teeth; hooked, in the rapacious kind, to catch and hold their prey; long and flender in thofe that have their food to grope for in moorifh places; and broad and long in thofe that fearch for it in the mud. Nor is the mouth lefs remarkable in infects; in fome it is forcipated, to catch, hold, and tear the prey; in others aculeated, to pierce and wound animals, and fuck their blood; in others, ftrongly rigid, with jaws and teeth, to gnaw and fcrape out their food, carry burdens, perforate the earth, nay the hardeft wood, and even ftones themfelves, for houfes and nefts for their young.

Mouvans. MOUVANS (Paul Richard), furnamed the *Brave*, a Proteftant officer, was born at Caftellane in Provence of a refpectable family, and made a confiderable figure in the civil wars of France during the 16th century. His brother, who was likewife a Proteftant, having been killed in a popular tumult excited by the Romifh priefts at Draguignan, he took up arms to avenge his death; and, having affembled 2000 men, committed great devaftations in Provence. Being purfued by the Count de Tende at the head of 6000 men, and finding himfelf too weak to keep the field, he took poft in a convent ftrongly fortified by nature, and there refolved to defend himfelf to the laft extremity. That the war might be terminated amicably, the Count de Tende propofed an interview; to which Mouvans agreed, on condition that his brother's murderers fhould be punifhed, and that thofe who had taken up arms with him fhould not be molefted. Thefe terms being accepted, he difmiffed his troops, referving only a guard of 50 men for the fecurity of his perfon. This precaution was not unneceffary; for the parliament of Aix had received orders from court to punifh him capitally for being concerned in the confpiracy of Amboife. The baron de la Garde made an attempt to apprehend him; but he was worfted and repulfed with confiderable lofs. Mouvans at length refolved to retire to Geneva, where his life would not be in danger; and there he lived for fome time in tranquillity, nobly rejecting the fplendid offers made him by the duke of Guife if he would join the Catholic party. He returned to France at the recommencement of the troubles, in confequence of the maffacre of Vaffy in 1562, and continued to diftinguifh himfelf in the Proteftant armies. His conduct at Sifterou, where he commanded together with Captain Senas when that city was befieged by the Count de Sommerive, is particularly deferving of admiration. After fuftaining an affault of feven hours, in which the befiegers were repulfed with confiderable lofs, Mouvans, perceiving that he was too weak to wait a fecond, determined to abandon the city, and left it during the night with his troops and thofe of the inhabitants who chofe to accompany him, by a pafs which the enemy had neglected to guard. The number of the inhabitants amounted to 4000 of every age and fex, men, women, children, and mothers with their infants at their breaft. This body, in which there was not 1000 men fit to bear arms, directed their courfe towards Grenoble. Mufketeers were placed in the front and rear, while the defencelefs and unarmed occupied the centre. To add to the difficulty of the march, they were frequently obliged to go out of the way, and to crofs fteep and rugged

rugged mountains, in order to avoid the ambuſcades which the enemy had laid for them on the road. They ſtopped ſome days to refreſh themſelves in the valleys of Angrone and Pragelas, where they were cordially received and ſupplied with proviſions by the Vaudois. After a march of 21 or 22 days, and being expoſed to the greateſt fatigue and famine, the wretched fugitives at length arrived at Grenoble. The baron des Adrets ſent them under an eſcort to Lyons, where they remained till the treaty of pacification. In 1568 Mouvans was defeated at Méſignae in Perigord, and loſt his life in the engagement. Upon this occaſion he commanded, together with Peter-Gourde, the advanced guard of the Proteſtant army. It is alleged, that in deſpair he daſhed out his brains againſt a tree.

MOWEE, one of the Sandwich iſlands diſcovered by Captain Cook, is 162 miles in circumference. A low iſthmus divides it into two circular peninſulas, of which the eaſtern is double the ſize of the weſtern. The mountains in both riſe to an exceeding great height, and may be ſeen at the diſtance of more than 30 leagues. The northern ſhores, like thoſe of Owyhee, afford no ſoundings, and the country preſents the ſame appearance of verdure and fertility. Near the weſt point of the ſmaller peninſula is a ſpacious bay, with a ſandy beach ſhaded with cocoa-nut trees. The country behind has a moſt romantic appearance, the hills riſing almoſt perpendicularly in a great variety of peaked forms; and their ſteep ſides and deep chaſms between them are covered with trees. The tops of theſe hills are entirely bare, and of a reddiſh brown colour. The number of inhabitants are computed at about 65,000. E. Long. 204. 4. N. Lat. 20. 50.

MOXA, or MUGWORT of China; is a ſoft lanuginous ſubſtance, prepared in Japan from the young leaves of a ſpecies of ARTEMISIA, by beating them together when thoroughly dried, and rubbing them betwixt the hands till only the fine fibres are left. The down on the leaves of mullein, cotton, hemp, &c. do as well as moxa.

In the Eaſtern countries it is uſed by burning it on the ſkin: a little cone of the moxa is laid upon the part, previouſly moiſtened, and ſet on fire at the top; it burns down with a temperate glowing heat, and produces a dark-coloured ſpot, the exulceration of which is promoted by applying a little garlic; the ulcer is left to diſcharge, or is ſoon healed, according to the intention in uſing the moxa. See ARTEMISIA.

MOYLE (Walter), a learned Engliſh writer in the 18th century, deſcended of a good family in Cornwall, where he was born in 1672. He was ſent to Oxford, and thence removed to the temple; where he applied himſelf chiefly to the general and more noble parts of the law, ſuch as led him to the knowledge of the conſtitution of the Engliſh government. In 1697 he had a ſhare with Mr Trenchard in writing a pamphlet, intitled, "An Argument ſhowing that a Standing Army is inconſiſtent with a Free Government, and abſolutely deſtructive to the Conſtitution of the Engliſh Monarchy." He tranſlated Xenophon's Diſcourſe upon Improving the State of Athens. He was for ſome time member of parliament, in which he always acted an honourable part; applying himſelf to the improvement and regulation of trade, and the employment of the poor, which has ſo near a connection with trade. He afterwards retired to his ſeat at Bake in Cornwall, where he applied himſelf with vigour to his ſtudies, and died in 1721. In 1726, his works were printed at London, in 2 vols 8vo.

MOYRA. See MOIRA.

MUCILAGE, in pharmacy, is in general any viſcid or glutinous liquor.

MUCILAGE, alſo imports the liquor which principally ſerves to moiſten the ligaments and cartilages of the articulations, and is ſupplied by the mucilaginous glands.

MUCOR, in botany: A genus of the order of fungi, belonging to the cryptogamia claſs of plants. The fungus has veſicular heads ſupported by foot-ſtalks.—There are 12 ſpecies; the moſt remarkable of which are, 1. The ſpærocephalus, or grey round-headed mucor, growing upon rotten wood, and ſometimes upon decayed plants and moſſes. The ſtalks of this are generally black, about a line in height; bearing each at the top a ſpherical ball about the ſize of a pin's head; its coat or rind is covered with a grey powder, and containing within a black or fuſcous ſpongy down. The coat burſts with a ragged, irregular margin. 2. The lichenoides, or little, black, pin-headed mucor. This ſpecies grows in groups near to each other, in chaſms of the barks of old trees, and upon old park-pales. The ſtalks are black, about two lines in height; bearing each a ſingle head, ſometimes a double or treble one, of the ſize of muſtard or poppy ſeeds, of a roundiſh figure at firſt, but when burſt often flattiſh or truncated, and of a black colour. The internal powdered down is black, with a tinge of green. 3. The mucedo, or common grey mould, grows on bread, fruits, plants, and other ſubſtances in a putrid ſtate. It grows in cluſters; the ſtalks a quarter of an inch high, pellucid, hollow, and cylindrical; ſupporting each a ſingle globular head, at firſt tranſparent, afterwards dark grey; which burſts with elaſtic force, and ejects ſmall round ſeeds diſcoverable by the microſcope. 4. The glaucus, or grey cluſter-headed mould, is found on rotten apples, melons, and other fruits; as alſo upon decayed wood, and the ſtalks of wheat. Theſe are of a pellucid grey colour; the ſtalks generally ſingle, ſupporting a ſpherical ball, which, when magnified, appears to be compounded of numerous, fine, moniliform, necklace-like radii. 5. The cruſtaceus, or fingered mould, is frequent upon corrupted food of various kinds. It is of a white aqueous colour; the ſtalks ſingle, each ſupporting at the top four or five necklace-like radii, diverging from the ſame point or centre. 6. The ſepticus, or yellow frothy mucor, is found on the leaves of plants, ſuch as ivy and beech, &c. ſometimes upon dry ſticks, and frequently upon the tan or bark in hot-houſes. It is of no certain ſize or figure, but of a fine yellow colour, and a ſubſtance reſembling at firſt cream beat up into froth. In the ſpace of 24 hours it acquires a thin filmy coat, becomes dry, and full of a ſooty powder adhering to downy threads. The ſeeds under the microſcope appear to be globular. Haller ranks it under a new genus, which he terms *fuligo;* the characters of which are, that the plants contained under it are ſoft, and like butter at firſt, but ſoon change into a black ſooty powder.

MUCUS, a mucilaginous liquor ſecreted by certain glands,

glands, and serving to lubricate many of the internal cavities of the body. In its natural state it is generally limpid and colourless; but, from certain causes, will often assume a thick consistence and whitish colour like pus. As it is sometimes of very great importance in medicine to distinguish these two fluids from each other, this was lately proposed as the subject of a prize disputation by the Æsculapian Society of Edinburgh. The prize was gained by Mr Charles Darwin student of medicine from Litchfield. The conclusions drawn from his experiments were,

1. Pus and mucus are both soluble in the vitriolic acid, though in very different proportions, pus being by far least soluble.

2. The addition of water to either of these compounds decomposes it. The mucus thus separated either swims in the mixture or forms large flocculi in it; whereas the pus falls to the bottom, and forms, on agitation, an uniform turbid mixture.

3. Pus is diffusible through a diluted vitriolic acid, though mucus is not. The same also occurs with water, or with a solution of sea-salt.

4. Nitrous acid dissolves both pus and mucus. Water added to the solution of pus produces a precipitate, and the fluid above becomes clear and green, while water and the solution of mucus form a turbid dirty-coloured fluid.

5. Alkaline lixivium dissolves, though sometimes with difficulty, mucus, and generally pus.

6. Water precipitates pus from such a mixture, but does not mucus.

7. Where alkaline lixivium does not dissolve pus, it still distinguishes it from mucus, as it then prevents its diffusion through water.

8. Coagulable lymph is neither soluble in concentrated nor diluted vitriolic acid.

9. Water produces no change on a solution of serum in alkaline lixivium, until after long standing, and then only a very slight sediment appears.

10. Corrosive sublimate coagulates mucus, but does not pus.

From the above experiments it appears, that strong vitriolic acid and water, diluted vitriolic acid, and caustic alkaline lixivium and water, will serve to distinguish pus from mucus; that the vitriolic acid can separate it from coagulable lymph, and alkaline lixivium from serum.

Hence, when a person has any expectorated matter, the decomposition of which he wishes to ascertain, let him dissolve it in vitriolic acid, and in caustic alkaline lixivium; and let him add pure water to both solutions. If there be a fair precipitation in each, he may be assured that some pus is present. But if there be a precipitation in neither, it is a certain test that the mixture is entirely mucus. If the matter cannot be made to dissolve in alkaline lixivium by time and trituration, we have also reason to believe that it is pus.

MUCK, or RUNNING A MUCK, is a practice that has prevailed time immemorial in Batavia. To run a muck, in the original sense of the word, is to get intoxicated with opium, and then rush into the street with a drawn weapon, and kill any one that comes in the way, till the party is himself either killed or taken prisoner. If the officer takes one of these *amocks* or *mohawks* (as they have been called by an easy corruption) alive, he has a considerable reward; and the unhappy wretches are always broken alive on the wheel: but such is the fury of their desperation, that three out of four are necessarily destroyed in attempting to secure them.

MUD-IGUANA. See MURÆNA.

MUFFLE, in chemistry, a vessel much used in some metallurgic operations. In figure it represents an oblong arch or vault, the hinder part of which is closed by a semicircular plane, and the lower part or floor of which is a rectangular plane. It is a little oven that is placed horizontally in assay and enamelling furnaces, so that its open side corresponds with the door of the fire-place of the furnace. Under this arched oven small cupels or crucibles are placed; and the substances contained are thus exposed to heat without contact of fuel, smoke, or ashes.

MUFTI, the chief of the ecclesiastical order, or primate of the mussulman religion. The authority of the mufti is very great in the Ottoman empire; for even the sultan himself, if he would preserve any appearance of religion, cannot, without hearing his opinion, put any person to death, or so much as inflict any corporal punishment. In all actions, especially criminal ones, his opinion is required, by giving him a writing in which the case is stated under feigned names; which he subscribes with the words, *He shall*, or *Shall not be, punished.* Such outward honour is paid to the mufti, that the grand signior himself rises up to him, and advances seven steps to meet him when he comes into his presence. He alone has the honour of kissing the sultan's left shoulder, whilst the prime vizier kisses only the hem of his garment. When the grand signior addresses any writing to the mufti, he gives him the following titles: *To the esad, the wisest of the wise, instructed in all knowledge, the most excellent of excellents, abstaining from things unlawful, the spring of virtue and of true science, heir of the prophetic doctrines, resolver of the problems of faith, revealer of the orthodox articles, key of the treasures of truth, the light to the doubtful allegories, strengthened with the grace of the supreme Legislator of mankind, may the Most High God perpetuate thy virtues!* The election of the mufti is solely in the grand signior, who presents him with a vest of rich sables, &c. If he is convicted of treason, or any great crime, he is put into a mortar kept for that purpose in the Seven Towers at Constantinople, and pounded to death.

MUGGLETONIANS, a religious sect which arose in England about the year 1657; so denominated from their leader Lodowick Muggleton, a journeyman taylor, who, with his associate Reeves, set up for great prophets, pretending, as it is said, to have an absolute power of saving and damning whom they pleased; and giving out that they were the two last witnesses of God that should appear before the end of the world.

MUGIL, the MULLET; in ichthyology, a genus of fishes belonging to the order of abdominales. The lips are membranaceous, the inferior one being carinated inwards; they have no teeth; the branchiostege membrane has seven crooked rays; the opercula are smooth and round; and the body is of a whitish colour. There are two species, distinguished by the number of rays in the back-fin.

The mullet is justly ranked by Aristotle among the *pisces littorales*, or those that prefer the shores to the full

Mugil || Mulberry.

full sea; they are found in great plenty on several of the sandy coasts of our island, and haunt in particular those small bays that have influxes of fresh water. They come in great shoals, and keep rooting like hogs in the sand or mud, leaving their traces in form of large round holes. They are very cunning; and when surrounded with a net, the whole shoal frequently escapes by leaping over it; for when one takes the lead, the others are sure to follow. This circumstance is observed by Oppian; who also informs us, that if these fishes fail to get over at the first leap, they never attempt a second, but lie without motion as if they resigned themselves to their fate. Mr Pennant says he is uncertain whether this last observation holds good or not: however, Oppian had good opportunity of examining those fish, as they sometimes swarm on the coasts of the Mediterranean. Near Martegues, in the south of France, abundance of mullets are taken in weres made of reeds placed in the shallows. Of the milts of the males, which are there called *allctants*, and of the roes of females, which are called *botar*, is made botargo. The materials are taken out entire, covered with salt for four or five hours, then pressed a little between two boards or stones, washed, and at last dried in the sun for 13 or 14 days.

This fish was sometimes made the instrument of a horrible punishment for unfortunate gallants. It was used both at Athens and Rome; but it is very doubtful whether it was a legal punishment or not. By Horace it is mentioned in the following lines:

Discincta tunica fugiendum est, ac pede nudo;
Ne nummi pereant, aut PYGA, *aut denique fama.*
SAT. II. lib. i. 132.

The mullet is an excellent fish for the table, but at present not a fashionable one. The albula * is caught in great quantities about the Bahama islands at the times they go in shoals to spawn; and is there esteemed very good eating.

* Plate CCCXV.

MUGWORT, in botany; a species of ARTEMISIA. An infusion of this plant in white wine, or a bath made of it, has been always esteemed an emmenagogue, and useful in difficult parturition. The leaves, when young and tender, are frequently made use of by the Highlanders of Scotland as a pot herb. The country-people in Sweden drink a decoction of them for the ague.

MUID, a large measure in use among the French, for things dry. The muid is no real vessel used as a measure, but an estimation of several other measures; as the septier, mine, minot, bushel, &c.

MUID, is also one of the nine casks, or regular vessels used in France, to put wine and other liquors in. The muid of wine is divided into two demi-muids, four quarter-muids, and eight half-quarter muids, containing 36 septiers.

MULATTO, a name given in the Indies to those who are begotten by a negro man on an Indian woman, or by an Indian man on a negro woman.

MULBERRY, in botany. See MORUS.

MULBERRY-Cyder, a name given by the people of Devonshire, and some other parts of England, to a sort of cyder rendered very palatable by an admixture of mulberry juice in the making: they choose for this purpose the ripest and blackest mulberries, and pressing out their juice and mixing it with a full-bodied cyder at the time of the grinding and pressing, give just so much of it as adds a perceptible flavour. It is very worthy the attention of people who live in other countries, where strong and good cyder is made, that this renders it a sort of wine much more agreeable than any other English liquor, and might be brought into general use, to the great advantage of the dealer. The colour of this liquor resembles that of the brightest red wine, and the flavour of the mulberry never goes off. Phil. Transf. N° 133.

Mulct, Mule.

MULCT, a fine of money laid upon a man who has committed some fault or misdemeanour.

MULE, in zoology, a mongrel kind of quadruped, usually generated between an ass and a mare, and sometimes between a horse and a she-ass; but the signification of the word is commonly extended to every kind of animal produced by a mixture of two different species. There are two kinds of these animals; one from the he-ass and mare, the other from the horse and the she-ass. We call them indifferently *mules*, but the Romans distinguished them by proper appellations. The first kind are the best and most esteemed; as being larger, stronger, and having least of the ass in their disposition. The largest and stoutest asses, and the fairest and finest mares, are chosen in those countries where these creatures are most in use; as in Spain, Italy, and Flanders. In the last especially, they succeeded in having very stately mules from the size of their mares, some of them 16 and some 17 hands high, which are very serviceable as sumpter-mules in the army. But since the Low Countries are no longer under the dominion of Spain, they breed fewer mules. These creatures are very much commended for their being stronger, surer footed, going easier, being more cheaply maintained, and lasting longer than horses. They are commonly of a black-brown, or quite black, with that shining list along the back and cross the shoulders which distinguishes asses. In former times they were much more common in this country than at present; being often brought over in the days of Popery by the Italian prelates. They continued longest in the service of millers; and are yet in use among them in some places, on account of the great loads they carry on their back. As they are capable of being trained for riding, bearing burdens, and for draught, there is no doubt that they might be usefully employed in many different services. But they are commonly found to be vicious, stubborn, and obstinate to a proverb; which whether it occasions or is produced by the ill usage they meet with, is a point not easily settled. Whatever may be the case of asses, it is allowed that mules are larger, fairer, and more serviceable in mild than in warm climates. In the British American colonies, both on the continent and in the islands, but especially in the latter, they are much used and esteemed; so that they are frequently sent to them from hence, suffer less in the passage, and die much seldomer than horses, and commonly yield, when they arrive, no inconsiderable profit.

It has commonly been asserted, that animals produced by the mixture of two heterogeneous species are incapable of generating, and thus perpetuating the monstrous breed; but this, we are informed by M. Buffon, is now discovered to be a mistake. Aristotle, says he, tells us, that the mule engenders with the mare, and that the junction produces an animal which the Greeks call *hinnus*, or *ginnus*. He like-

wife remarks, that the fhe-mule eafily conceives, but feldom brings the fœtus to perfection. But the moft remarkable and well attefted inftance of this fact, is mentioned in a letter read by M. d'Alembert before the academy of fciences, which informed him that a fhe-mule in the ifland of St Domingo had brought forth a foal. The fact was attefted by perfons of the moft unqueftionable veracity; and other inftances, though not fo well authenticated, are adduced by our author. We may therefore, continues M. Buffon, confider it as an eftablifhed fact, that the he-mule can generate and the fhe-mule produce. Like other animals, they have a feminal liquor, and all the organs neceffary to generation. But mongrel animals are always lefs fertile and more tardy than thofe of a pure fpecies. Befides, mules have never produced in cold climates, feldom in warm regions, and ftill more feldom in temperate countries. Hence their barennefs, without being abfolute, may be regarded as pofitive; fince their productions are fo rare, that a few examples can be only collected.

The tranflator of Buffon's works, in a note on the paffage above-quoted, has given a remarkable and well authenticated inftance of the prolific powers of a fhe-mule in the north of Scotland. Having heard that a mule, belonging to Mr David Tullo farmer in Auchtertyre, in the county of Forfar, had fome years ago brought forth a foal, he tranfmitted a few queries to be put to Mr Tullo; and requefted that his anfwers might be legally attefted before a magiftrate. This requeft was cheerfully complied with; and the following is an exact copy of the queries, anfwers, and atteftations.

Interrogatories to be put to Mr Tullo tenant in Auchtertyre, parifh of Newtyle, and county of Forfar, with his anfwers thereto.

1mo, Had you ever a fhe-mule? At what period? Is it true that the mule had a foal? At what time was fhe covered; and when did fhe foal?—Anfwered by Mr Tullo: That he bought a fhe-mule about 20 years ago: That fhe was conftantly in feafon for a horfe: That, about fome years thereafter, he gave her a horfe; and that fhe thereafter gave him a foal, about the 10th of June. The mule's price was L. 4, 5 s. Sterling.

2do, What was the colour of the foal? Was there any thing particular in its figure?—Anfwer: The foal was exactly the colour of its mother, inclined to black, with a very large head, big ears, and fmall tail; and the declarant thinks, had its head been weighed when foaled, it would have weighed nearly as much as its body.

3tio, How long was the animal allowed to live?—Anfwer: The next day after the mule foaled, it was fent, with its mother, to the Loch of Lundie, in order to let the foal die, as the declarant could not want the mule's work, and the mother feemed not fond of the foal: That it was accordingly left, and next day came to Auchtertyre, about two miles diftance, over a hill, with the cattle of Auchtertyre, that had been grazing near to that place, and was drowned in a ditch the day following.

4to, Was its fkin preferved, or the head, or any other bones of the fkeleton? Could any part thereof be ftill found?—Anfwered: Neither the fkin nor any part of the fkeleton was preferved, nor can be now had; though the declarant has often regretted the not preferving the foal, as its mother always performed any work that a horfe of 15 l. value could do.

5to, Is the mother ftill alive? What is her age?—Anfwer: The mother died about eight years ago, of an epidemic cold that was raging among the horfes in this country: The mule had little or no milk after foaling, and the foal got fome cow's milk: And this is all that he remembers of the matter. David Tullo.

Auchtertyre, 4th Feb. 1780. We James Small tenant in Burmouth, and Robert Ramfay tenant in Newtyle, hereby certify, That we have often feen the mule above-defcribed; and we know that fhe had a foal, as is narrated by David Tullo.

James Small. Rob. Ramsay.

Ballantyne houfe, 4th Feb. 1780. The within interrogatories were put to David Tullo tenant in Auchtertyre, anent the mule he had, and the foal fhe produced; to which he gave the anfwers fubjoined to each query, and figned them; as did James Small and Robert Ramfay, attefting the truth thereof, in prefence of George Watson, J. P.

The original atteftation is in the poffeffion of the tranflator; and he lately tranfmitted notorial or authenticated copies of it to the count de Buffon, and to Thomas Pennant, Efq; of Downing, in Flintfhire.

Mules, among gardeners, denote a fort of vegetable monfters produced by putting the farina fœcundans of one fpecies of plant into the piftil or utricle of another.

The carnation and fweet-william being fomewhat alike in their parts, particularly their flowers, the farina of the one will impregnate the other, and the feed fo enlivened will produce a plant differing from either. An inftance of this we firft had in Mr Fairchild's garden at Hoxton; where a plant is feen neither fweet-william nor carnation, but refembling both equally: this was raifed from the feed of a carnation that had been impregnated by the farina of the fweetwilliam. Thefe couplings being not unlike thofe of the mare with the afs, which produce the mule, the fame name is given them; and they are, like the others, incapable of multiplying their fpecies.

This furnifhes a hint for altering the property and tafte of any fruit, by impregnating one tree with the farina of another of the fame clafs; *e. gr.* a codlin with a pear-main, which will occafion the codlin fo impregnated to laft a longer time than ufual, and to be of a fharper tafte. Or if the winter-fruits be fecundated with the duft of the fummer kinds, they will ripen before their ufual time. And from this accidental coupling of the farina of one with another, it may poffibly be, that an orchard where there is variety of apples, even the fruit gathered from the fame tree differ in their flavour, and in the feafon of maturity. It is alfo from the fame accidental coupling that the numberlefs varieties of fruits and flowers raifed every day from feed proceed.

Wild or Fecund Mule. See Equus, p. 712.

MULHAUSEN, an imperial and Hanfeatic town of Germany, in Upper Saxony, and in Thuringia, under the protection of the elector of Saxony; feated in

Mulhausen || Muller.

in a fertile country, on the river Unftrutht, 15 miles north eaft of Eifenach, and 45 eaft by fouth of Caffel. E. Long. 10. 49. N. Lat. 51. 13.

MULHAUSEN, a confiderable town of Germany, in Alface, and capital of a republic in alliance with the Swifs. It is populous, well built, and adorned with handfome public ftructures; feated in a pleafant fertile country, on an ifland formed by the river Ill, 15 miles north-weft of Bafle, and 20 eaft of Befort. E. Long. 7. 24. N. Lat. 47. 48.

MULIER, in law, fignifies the lawful iffue born in wedlock, though begotten before. The mulier is preferred to an elder brother born out of matrimony; as for inftance, if a man has a fon by a woman before marriage, which iffue is a baftard, and afterwards marries the mother of the baftard, and they have another fon, this fecond fon is mulier and lawful, and fhall be heir of the father; but the other can be heir to no perfon*. By the civil law, where a man has iffue by a woman, if after that he marries her, the iffue is mulier.

* See the article *Baftard.*

MULL, one of the Weftern Iflands of Scotland, about 25 miles long, and as much in breadth. It is in general rocky and barren, not producing a fufficient quantity of corn for the inhabitants; but a great number of cattle are annually exported, which with the fifhings and a confiderable quantity of kelp are the only articles of commerce. It is deeply indented with bays and creeks, forming in feveral parts good natural harbours. There are no villages except Tobermorey, near the northern point of the ifland, where a fifhing ftation has been lately erected. The ifland was originally part of the dominions of the Lords of the Ifles; but in after-times it became part of the poffeffions of the ancient and valiant family of Macleans, who ftill retain one-half. The other is the litigated property of the duke of Argyle, whofe anceftor poffeffed himfelf of it in 1674, on account of a debt; but after the courts of law had made an adjudication in his favour, he was obliged to fupport their decree by force of arms. The ruins of feveral ancient caftles are feen on this ifland.

Mull of Cantyre. See CANTYRE.

Mull of Galloway. See GALLOWAY.

MULLEIN. See VERBASCUM.

MULLER or REGIOMONTANUS (John), a celebrated aftronomer of the 15th century, was born at Koningfhoven in Franconia in 1436, and acquired great reputation by publifhing an abridgment of Ptolemy's Almageft, which had been begun by Purback. He went to Rome to perfect himfelf in the Greek tongue, and to fee the Cardinal Baffarion; but finding fome faults in the Latin tranflations of George de Trebizond, that tranflator's fon affaffinated him in a fecond journey he made to Rome in 1476, where Pope Sextus IV. had provided for him the archbifhopric of Ratifbon, and had fent for him to reform the calendar. Others fay that he died of the plague.

MULLER (John), a noted engraver, who flourifhed about the year 1600, and had been bred under Henry Goltzius, whofe ftyle he clofely imitated. The facility with which he handled the graver (for he worked with that inftrument only) cannot be fufficiently expreffed; his works muft be feen, to convey a proper idea of it to the mind. His engravings are valuable, as productions of a very extraordinary nature; exclufive of which they have a prodigious fhare of merit. Among his moft eftimable performances, may be mentioned, 1. The hand writing on the wall, a middling-fized plate lengthwife, from his own compofition. 2. The adoration of the wife men, the fame, from the fame. Fine impreffions of both thefe prints are very rare. 3. The refurrection of Lazarus, a large plate lengthwife, from Abraham Bloemart. He engraved alfo feveral much efteemed portraits.

Muller || Mullus.

MULLER, or *Mullar*, denotes a ftone flat and even at bottom, but round atop; ufed for grinding of matters on a marble.—The apothecaries ufe mullers to prepare many of their teftaceous powders; and painters for their colours, either dry or in oil.

MULLER is an inftrument ufed by the glafs-grinders; being a piece of wood, to one end whereof is cemented the glafs to be ground, whether convex in a bafon, or concave in a fphere or bowl.—The muller is ordinarily about fix inches long, turned round: the cement they ufe is compofed of afhes and pitch. See GRINDING.

MULLERAS, a town of Germany, in the circle of Upper Saxony, and marquifate of Brandenburg, feated 38 miles fouth of Berlin, upon a canal which joins the Oder and the Spree. This canal is 15 miles in length, 10 yards in breadth, and feven feet in depth. It was eight years in making; and fince that time the cities of Hamburg and Breflaw have carried on great trade by water. E. Long. 14. 50. N. Lat. 52. 21.

MULLET, in ichthyology. See MUGIL.

MULLET, or *Mollet*, in heraldry, a bearing in form of the rowel of a fpur, which it originally reprefented.

MULLINGAR, a borough or manor in the county of Weftmeath, and province of Leinfter, in Ireland, 38 miles from Dublin. It is the fhire town of that county, and has a barrack for two troops of horfe. It returns two members to parliament; patron the earl of Granard. This is a poft town. N. Lat. 53. 30. W. Long. 7. 50. Within a few miles of it are the ruins of a church, and alfo thofe of a caftle. It is fituated on the river Feyle. It holds a great wool fair, and is a place of good trade. In 1227, the priory of St Mary, formerly known by the name of *The Houfe of God of Mullingar*, was founded here by Ralph de Petyt bifhop of Meath, for regular canons of the order of St Auguftin. A Dominican friary was alfo founded here in 1237 by the family of Nugent; fome ruins of which ftill remain. In 1622, the friars of Multifarnham began to erect a houfe here for friars of the order of St Francis, but it was never completed. Fairs are held here 6th April, 4th and 5th July, 29th Auguft, and 11th November.

MULLUS, the SURMULLET, in ichthyology, a genus of fifhes belonging to the order of thoracici. See Plate CCCXV. This fifh was highly efteemed by the Romans, and bore an exceeding high price. The capricious epicures of Horace's days valued it in proportion to its fize; not that the larger were more delicious, but that they were more difficult to be got. The price that was given for one in the time of Juvenal

venal and Pliny is a ftriking evidence of the luxury and extravagance of the age :

> Mullum *fex millibus emit*
> *Æquantem fane paribus feftertia libris* *. Juv. Sat. IV.
> The lavifh flave
> Six thoufand pieces for a mullet gave,
> A fefterce for each pound. Dryden.

* L. 48, 9 d.

Pennant.

But Afinius Celer, a man of confular dignity, gave a ftill more unconfcionable fum ; for he did not fcruple beftowing 8000 *nummi*, or 64 l. 11 s. 8 d. for a fifh of fo fmall a fize as the mullet : for, according to Horace, a *mullus trilibris*, or one of three lb. was a great rarity; fo that Juvenal's fpark muft have had a great bargain in comparifon of what Celer had. But Seneca fays, that it was not worth a farthing except it died in the very hand of your gueft ; that fuch was the luxury of the times, that there were ftews even in the eating-rooms, fo that the fifh could at once be brought from under the table, and placed on it ; and that they put the mullets in tranfparent vafes, that they might be entertained with the various changes of its rich colour while it lay expiring. Apicius, a wonderful genius for luxurious inventions, firft hit upon the method of fuffocating them in the exquifite Carthaginian pickle, and afterwards procured a rich fauce from their livers.— This is the fame gentleman whom Pliny, in another place, honours with the title of *Nepotum omnium altiffimus gurges* ; an expreffion too forcible to be rendered in our language. The body of this fifh is very thick, and covered with large fcales ; beneath them the colour is a moft beautiful rofy red, the changes of which under the thin fcales gave that entertainment to the Roman epicures as above-mentioned : the fcales on the back and fides are of a dirty orange ; thofe on the nofe a bright yellow ; the tail a reddifh yellow.

MULTIPLE, in arithmetic, a number which comprehends fome other feveral times : thus 6 is a multiple of 2, and 12 is a multiple of 6, 4, and 3 ; comprehending the firft twice, the fecond thrice, &c.

Action of MULTIPLEPOINDING, in Scots law. See Law, n° clxxxiii. 24.

MULTIPLICAND, in arithmetic, the number to be multiplied by another. See Arithmetic.

MULTIPLICATION, in general, the act of increafing the number of any thing.

Multiplication, in arithmetic, is a rule by which any given number may be fpeedily increafed, according to any propofed number of times. See Arithmetic.

Multiplication, in algebra. See Algebra, p. 401.

MULTIPLICATOR, or Multiplier, in arithmetic, the number by which any other is multiplied, or the number of times it is fuppofed to be taken.

MULTIPLICATUS flos, a luxuriant flower, whofe petals are multiplied fo as to exclude a part of the ftamina.

A multiplied luxuriant flower differs from a full one, the higheft degree of luxuriance, in that the petals of the latter are fo multiplied as to exclude all the ftamina : whereas thofe of the former are only repeated or multiplied, two, three, or four times, as to the exclufion of only a fmall part of the effential organs.

MULTIPLYING-glass, in optics, a glafs wherewith objects appear increafed in number. See (the *Index* fubjoined to) Optics.

MULTURE, in Scots law, a certain ftipulated quantity of meal given as payment to the proprietor or tackfman of a mill for grinding the corn ; and all corn ground on farms thirled to the mill is obliged to pay multure whether the corn be ground at that mill or elfewhere.

MULVIA, a river of Barbary in Africa, which rifes in the mountains of Atlas, and divides the empire of Morocco from that of Algiers, and then falls into the Mediterranean, to the weftward of Marfalquiver.

MUM, a kind of malt-liquor much drank in Germany, and chiefly brought from Brunfwick, which is the place of moft note for making it. The procefs of brewing mum, as recorded in the town-houfe of that city, is as follows. Take 63 gallons of water that has been boiled till one-third part is confumed, and brew it with feven bufhels of wheaten malt, one bufhel of oat-meal, and one bufhel of ground beans. When it is tunned, the hogfhead muft not be filled too full at firft : as foon as it begins to work, put into it three pounds of the inner rind of fir, one pound of the tops of fir and beech, three handfuls of carduus benedictus, a handful or two of the flower of rofa folis : add burnet, betony, marjoram, avens, pennyroyal, and wild thyme, of each an handful and an half ; of elder-flowers, two handfuls or more ; feeds of cardamum bruifed, 30 ounces ; barberries bruifed, one ounce : when the liquor has worked a while, put the herbs and feeds into the veffel ; and, after they are added, let it work over as little as poffible ; then fill it up : laftly, when it is ftopped, put into the hogfhead ten new-laid eggs unbroken ; ftop it up clofe, and ufe it at two years end. The Englifh brewers, inftead of the inner rind of fir, ufe cardamum, ginger, and fafafras ; and alfo add elicampane, madder, and red fanders.

MUMIA. See Pissaphaltum.

MUMMIUS (L.), a Roman conful fent againft the Achæans, whom he conquered B. C. 147. He deftroyed Corinth, Thebes, and Chalcis, by order of the fenate, and obtained the furname of *Achaicus* from his victories. He did not enrich himfelf with the fpoils of the enemy, but returned home without any increafe of fortune. He was fo unacquainted with the value of the paintings and works of the moft celebrated artifts of Greece which were found in the plunder of Corinth, that he faid to thofe who conveyed them to Rome, that if they loft them or injured them, they fhould make others in their ftead.

MUMMY, a body embalmed or dried, in the manner ufed by the ancient Egyptians ; or the compofition with which it is embalmed. There are two kinds of bodies denominated *mummies*. The firft are only carcafes dried by the heat of the fun, and by that means kept from putrefaction : thefe are frequently found in the fands of Libya. Some imagine, that thefe are the bodies of deceafed people buried there on purpofe to keep them entire without embalming ; others think they are the carcafes of travellers who have been overwhelmed by the clouds of fand raifed by the hurricanes frequent in thofe defarts. The fecond kind of mummies are bodies taken out of the catacombs near Cairo, in which the Egyptians depofited their dead after embalming. See Embalming.

We have two different ſubſtances preſerved for medicinal uſe under the name of *mummy*, though both in ſome degree of the ſame origin. The one is the dried and preſerved fleſh of human bodies, embalmed with myrrh and ſpices; the other is the liquor running from ſuch mummies, when newly prepared, or when affected by great heat or damps. The latter is ſometimes in a liquid, ſometimes of a ſolid form, as it is preſerved in vials well ſtopped, or ſuffered to dry and harden in the air. The firſt kind of mummy is brought to us in large pieces, of a lax and friable texture, light and ſpungy, of a blackiſh brown colour, and often damp and clammy on the ſurface: it is of a ſtrong but diſagreeable ſmell. The ſecond kind of mummy, in its liquid ſtate, is a thick, opaque, and viſcous fluid, of a blackiſh colour, but not diſagreeable ſmell. In its indurated ſtate, it is a dry ſolid ſubſtance, of a fine ſhining black colour, and cloſe texture, eaſily broken, and of a good ſmell; very inflammable, and yielding a ſcent of myrrh and aromatic ingredients while burning. This, if we cannot be content without medicines from our own bodies, ought to be the mummy uſed in the ſhops; but it is very ſcarce and dear; while the other is ſo cheap, that it will always be moſt in uſe.

All theſe kinds of mummies are brought from Egypt. But we are not to imagine, that any body breaks up the real Egyptian mummies, to ſell them in pieces to the druggiſts, as they make a much better market of them in Europe whole, when they can contrive to get them. What our druggiſts are ſupplied with, is the fleſh of executed criminals, or of any other bodies the Jews can get, who fill them with the common bitumen, ſo plentiful in that part of the world; and adding a little aloes, and two or three other cheap ingredients, ſend them to be baked in an oven, till the juices are exhaled, and the embalming matter has penetrated ſo thoroughly that the fleſh will keep and bear tranſporting into Europe. Mummy has been eſteemed reſolvent and balſamic: but whatever virtues have been attributed to it, ſeem to be ſuch as depend more upon the ingredients uſed in preparing the fleſh than in the fleſh itſelf; and it would ſurely be better to give thoſe ingredients without ſo ſhocking an addition.

There are found in Poland a kind of natural mummies, or human bodies preſerved without the aſſiſtance of art. Theſe lie in conſiderable numbers in ſome of the vaſt caverns in that country. They are dried with the fleſh and ſkin ſhrunk up almoſt cloſe to the bones, and are of a blackiſh colour. In the wars which ſeveral ages ago laid waſte that country, it was common for parties of the weaker ſide to retire into theſe caves, where their enemies, if they found them out, ſuffocated them by burning ſtraw, &c. at the mouth of the cavern, and then left the bodies; which, being out of the way of injuries from common accidents, have lain there ever ſince.

Mineral Mummy. See Pissaphaltum.

Mummy, among gardeners, a kind of wax uſed in grafting and planting the roots of trees, made in the following manner: Take one pound of black pitch, and a quarter of a pound of turpentine; put them together into an earthen pot, and ſet them on fire in the open air, holding ſomething in your hand to cover and quench the mixture in time, which is to be alternately lighted and quenched till all the nitrous and volatile parts be evaporated. To this a little common wax is to be added; and the compoſition is then to be ſet by for uſe.

MUMPS. See Medicine-*Index*.

MUNDA, an ancient town of Spain, in the kingdom of Granada, ſeated on the declivity of a hill, at the bottom of which runs a river. W. Long. 4. 13. N. Lat. 48. 15.

This city was anciently famous for a victory gained by Cæſar over the two ſons of Pompey, who had collected an army in Spain after the defeat of their father at Pharſalia. See *(Hiſtory of)* Rome.

The Pompeys poſted their army advantageouſly on a riſing ground, whereof one ſide was defended by the city of Munda, and the other by a ſmall river which watered the plain, and by a marſh; ſo that the enemy could not attack them but in front. Cæſar likewiſe drew up his troops with great art, and having advanced a little way from his camp, ordered them to halt, expecting the enemy would abandon their advantageous poſt, and come to meet him. But as they did not ſtir, Cæſar made as if he intended to fortify himſelf in that poſt; which induced the young general, who looked upon this as a ſign of fear, to advance into the plain, and attack the enemy before they could ſecure themſelves with any works. Pompey's army was by far the moſt numerous; for it conſiſted of 13 legions, 6000 horſe, and an incredible number of auxiliaries, among whom were all the forces of Bocchus king of Mauritania, commanded by his two ſons, both youths of great valour and bravery. Cæſar had 80 cohorts, three legions, to wit, the third, the fifth, and the tenth, and a body of 8000 horſe. As the enemy drew near, Cæſar betrayed a great deal of uneaſineſs and concern, as if he were doubtful of the ſucceſs, knowing he was to engage men no way inferior in valour and experience to his own, and commanded by officers who had on many occaſions given ſignal proofs of their bravery and conduct. Cneius, the elder of the two brothers, was generally looked upon as an able commander; and Labienus, who had revolted, eſteemed ſcarce inferior to himſelf.

However, the dictator, deſirous to put an end to the civil war, either by his own death or that of his rivals, gave the ſignal for the battle, and fell upon the enemy with his uſual vigour and reſolution. At the firſt onſet, which was dreadful, the auxiliaries on both ſides betook themſelves to flight, leaving the Romans to decide their quarrel by themſelves. Then the legionaries engaged with a fury hardly to be expreſſed; Cæſar's men being encouraged by the hopes of putting an end to all their labours by this battle, and thoſe of Pompey exerting themſelves out of neceſſity and deſpair, ſince moſt of them expected no quarter, as having been formerly pardoned. Never was victory more obſtinately diſputed. Cæſar's men, who had been always uſed to conquer, found themſelves ſo vigorouſly charged by the enemy's legionaries, that they began to give ground; and though they did not turn their backs, yet it was manifeſt that ſhame alone kept them in their poſts. All authors agree, that Cæſar had never been in ſo great danger; and he himſelf, when he came back to his camp, told his friends, that he had often fought for victory, but this was the firſt time he had ever fought for life. Thinking himſelf abandoned

ed by fortune, which had hitherto favoured him, he had ſome thoughts of ſtabbing himſelf with his own ſword, and by a voluntary death preventing the diſgrace of a defeat: but returning ſoon to himſelf, and concluding it would be more to his reputation to fall by the enemy's hand at the head of his troops, than, in a fit of deſpair, by his own, he diſmounted from his horſe, and ſnatching a buckler from one of his legionaries, he threw himſelf like a man in deſpair into the midſt of the enemy; crying out to his men, *Are you not aſhamed to deliver your general into the hands of boys?* At theſe words, the ſoldiers of the tenth legion, animated by the example of their general, fell upon the enemy with freſh vigour, and made a dreadful havock of them. But in ſpite of their utmoſt efforts, Pompey's men ſtill kept their ground, and, though greatly fatigued, returned to the charge with equal vigour. Then the Cæſarians began to deſpair of victory; and the dictator, running through the ranks of his diſheartened legionaries, had much ado to keep them together. The battle had already laſted from the riſing to the ſetting of the ſun, without any conſiderable advantage on either ſide.

At length a mere accident decided the diſpute in favour of the dictator. Bogud, a petty king of Mauritania, had joined Cæſar ſoon after his arrival in Spain, with ſome ſquadrons of Numidian horſe; but, in the very beginning of the battle, being terrified at the ſhouting of the ſoldiers, intermingled with groans, and the claſhing of their arms, he had abandoned his poſt, and retired with the auxiliaries under his command to a riſing ground at a ſmall diſtance from the enemy's camp. There he continued the whole day an idle ſpectator of the battle that was fought in the plain. But towards the evening, partly out of ſhame and partly out of compaſſion for his friend Cæſar, he reſolved to fall upon Pompey's camp; and accordingly flew thither with all the forces he had with him. Labienus, appriſed of his deſign, haſtened after him to the defence of the camp; which Cæſar obſerving, cried to his legionaries, *Courage, fellow ſoldiers! the victory at length is ours; Labienus flies.* This artifice had the deſired effect: Cæſar's men, believing that Labienus was truly fled, made a laſt effort, and charged the wing he commanded ſo briſkly, that after a moſt obſtinate diſpute they put them to flight.

Though the enemy's left wing was thus entirely defeated, the right wing, where the elder Pompey commanded, ſtill kept their ground for ſome time. Pompey diſmounting from his horſe, fought on foot like a private man in the firſt line, till moſt of his legionaries being killed, he was forced to ſave himſelf by flight from falling into the enemy's hands. Part of his troops fled back to their camp, and part took ſhelter in the city of Munda. The camp was immediately attacked, and taken ſword in hand; and as for the city, Cæſar, without loſs of time, drew a line of circumvallation round it. This victory was gained on the 16th of the kalends of April, *i. e.* according to our way of counting, on the 17th day of March, when the Dionyſian feſtival, or the Liberalia, were celebrated at Rome; the very day, as Plutarch obſerves, in which Pompey the Great, four years before, had ſet out for the war. In this action Pompey loſt 30,000 men; among whom were the famous Labienus, Attius Varus, and 3000 Roman knights. Seventeen officers of diſtinction were taken, and all the enemy's eagles and enſigns, together with Pompey's faſces, which he had aſſumed as governor of Spain. On Cæſar's ſide only 1000 men were killed and 500 wounded.

MUNDIC, or MARCASITE. See MARCASITE.

MUNDINGOES, the name of a people who live on the ſides of the river Gambia in Africa, and who are of a jet black colour, ſtrong, and well-made. They have a prieſt ſent over every year from one of the Cape de Verde iſlands to chriſten and marry.

MUNDUS PATENS, the open world, in Roman antiquity, a ſolemnity performed in a ſmall temple, of a round form like the world, dedicated to *Dis* and the reſt of the infernal gods. This temple was opened but three times in the year, *viz.* the 24th of Auguſt, the 4th of October, and the 7th of November. During theſe days, the Romans believed hell was open; on theſe days therefore they never offered battle, liſted ſoldiers, put out to ſea, or married.

MUNICH, a town of Germany, capital of the whole duchy of Bavaria, and the reſidence of the elector. It ſtands on the Iſer, 70 miles ſouth of Ratiſbon and 214 weſt of Vienna, being one of the moſt pleaſant and populous cities of Germany for its bigneſs. The number of the inhabitants is ſaid to be about 40,000. Having been built at firſt on a ſpot of ground belonging to a convent, it had from thence in German the name of *Munchen*, i. e. *Monk's-town*, and a monk for its arms. The elector's palace here is a very grand ſtructure, conſiſting of ſeveral courts, furniſhed and adorned in the moſt magnificent manner, with tapeſtry, gilding, ſculpture, ſtatues, and paintings. It contains an amazing collection of jewels, antiquities, and curioſities. The great hall is 118 feet long and 52 broad; and the ſtair-caſe leading to it, from top to bottom, of marble and gold. In the hall of antiquities are 354 buſts and ſtatues of jaſper and porphyry, braſs and marble. In this palace alſo is a library, containing a vaſt collection of books, and many valuable manuſcripts, in moſt languages, ancient and modern; and a chamber of rarities, among which is the picture of a bravo or aſſaſſin, who is ſaid to have committed 345 murders with his own hand, and to have been accomplice in or privy to 400 more. The treaſury in the chapel contains alſo a vaſt number of pictures, precious ſtones, medals, veſſels of gold and ſilver, &c. Among other curioſities, here is a cherry-ſtone with 140 heads diſtinctly engraven upon it. The gardens of the palace are alſo very fine, and it is ſaid a ſecret paſſage leads from it to all the churches and convents in the town. There is a great number of other fine buildings in this city, public and private, particularly the riding-houſe, town-houſe, opera-room, the Jeſuits college, the large edifice for tournaments, the churches, convents, fountains, &c. Its manufactures are thoſe of ſilk, particularly velvet, woollen cloths, and tapeſtry; and it has two annual fairs, at which great quantities of ſalt, wine, &c. are ſold. The ſtreets are broad and regular; and moſt of the houſes well built, and painted on the outſide. The market-place is extremely beautiful. Not far from Munich are four other palaces, with fine gardens, belonging to the elector, *viz.* thoſe of Sleiſheim, Nymphenburg, Dauchau, and Starenberg. The firſt and

laſt are about three leagues from the capital; the ſecond about half a league; and the third about two, at a market town of the ſame name.

Munich (Count de), was the favourite of the Czarina Ann, and was concerned in all the events of her reign. Being appointed general of her armies, he gained great advantages over the Crim Tartars, beat the Turks, A. D. 1739, in an engagement near Choczim, and took that city together with Jaſſi the capital of Moldavia. He was afterwards prime miniſter to the Czar Iwan VI. but in a ſhort time after he was accuſed of employing the power which his office conferred on him to gratify his own ambition and private reſentment. The Empreſs Eliſabeth brought him to trial, and he was condemned to loſe his life A. D. 1742. This ſentence was mitigated to baniſhment into Siberia, whither many of the victims of his power had been exiled. He was recalled by Peter III. A. D. 1762, and declared field-marſhal. Upon the death of this prince, the Empreſs Catharine II. appointed him director-general of the ports of the Baltic. He died on the 8th of October 1767, at the age of 84.

MUNICIPAL, in the Roman civil law, an epithet which ſignifies inveſted with the rights and privileges of Roman citizens. See Municipium.

Municipal, among us, is applied to the laws that obtain in any particular city or province. And thoſe are called *municipal officers* who are elected to defend the intereſt of cities, to maintain their right and privileges, and to preſerve order and harmony among the citizens; ſuch as mayors, ſheriffs, conſuls, &c.

MUNICIPES, an appellation given by the Romans to the inhabitants of the *municipia* or municipal cities. See Municipium.

MUNICPIUM, in Roman antiquity, a corporation, borough, or enfranchiſed city or town, where the inhabitants enjoyed their own laws and cuſtoms, and at the ſame time were honoured with the privileges of Roman citizens; but then this privilege generally reached no further than the bare title. Some indeed, by particular merit, obtained the liberty of votes, which occaſioned that diſtinction of *municipium ſine ſuffragio*, and *municipium cum ſuffragio*.—The inhabitants of the *municipium ſine ſuffragio* were called barely *Romani*, but thoſe of the *municipium cum ſuffragio* were called *cives Romani*.

The difference between proper citizens of Rome and the inhabitants of the municipium may be thus expreſſed. The proper citizens of Rome were, 1. Regiſtered in the cenſus; 2. Had the right of ſuffrage and of bearing honours; 3. Were aſſeſſed in the poll-tax; 4. Served in the legions; 5. Uſed the Roman laws and religion; 6. Were called *Quirites* and *populus Romanus*: Whereas the municipes enjoyed the three firſt of theſe privileges, but were denied the three laſt.

MUNITION, the proviſions with which a place is furniſhed in order for defence; or that which follows a camp for its ſubſiſtence.

Munition Ships, are thoſe that have ſtores on board in order to ſupply a fleet of men of war at ſea. In an engagement, all the munition-ſhips and victuallers attending the fleet take their ſtation in the rear of all the reſt; they are not to engage in the fight, but to attend to ſuch directions as are ſent them by the admiral.

MUNSTER (Sebaſtion), a learned writer, was born at Ingleheim, and became a Cordelier; but having embraced Luther's ſentiments, he quitted that order in 1529, and retired to Heidelberg, and afterwards to Baſil, where he taught with reputation. He was a man of great candour, and void of ambition; and was ſo well ſkilled in geography, the mathematics, and the Hebrew tongue, that he was furnamed the *Eſdras* and the *Strabo of Germany*. His Latin tranſlation of the bible is eſteemed. He was the firſt who wrote a Chaldee grammar and lexicon: he alſo publiſhed a treatiſe on coſmography, and ſeveral other works. He died of the plague at Baſil in 1552, aged 63.

Munster, in Latin *Monomia*, and in Iriſh *Moun*, the moſt ſoutherly province of Ireland; bounded on the north by Leinſter and Connaught, and on the eaſt, weſt, and ſouth, by the ocean. It contains the counties Cork, Clare, Kerry, Limerick, Tipperary, and Waterford; and 3,289,932 Iriſh plantation acres, 740 pariſhes, 63 baronies, and 26 boroughs. It is about 125 miles long and 120 broad; and its principal town is Cork. Its ancient name was *Mumhan*; and in latter ages it was divided into *Deſmond* or ſouth Munſter, *Ormond* or eaſt Munſter, and *Thomond* or north Munſter. It lies between 51. 15. and 53. 0. N. Lat. and 7. 10. to 10. 40. W. Long.

Munster, a territory of Germany, in the circle of Weſtphalia; bounded on the north by Embden and Oldenburg, on the ſouth by the county of Mark and duchy of Weſtphalia, on the weſt by the county of Bentheim and the United Provinces, and on the eaſt by the biſhoprics of Oſnaburg and Paderborn together with the county of Ravenſberg. It is the largeſt of all the Weſtphalian biſhoprics, being in length about 80 miles, and in breadth from 20 to 60. It is divided into 13 bailiwicks; and though in general but a barren country, has ſome fruitful plains, with woods, and quarries of ſtone. The inhabitants, excepting a few of the nobility and gentry, are all Roman Catholics; though Lutheraniſm had once a conſiderable footing here. The biſhop, who is generally alſo elector of Cologne, has a revenue from hence of about 70,000 pounds, and can maintain 8000 men. In conſequence of an unjuſt cuſtom, unknown in the reſt of the empire, he is heir to all ſtrangers who die in the country without children. In the matricula he is rated at 30 foot and 118 horſe; or 832 florins monthly in lieu of them. His chapter conſiſts of 40 canons, who are all noble.

Munster, a city of Germany, capital of a biſhopric of the ſame name and of all Weſtphalia, ſtands at the conflux of the river Aa with the Ems, in E. Long. 7. 49. N. Lat. 52. 0. It is of a circular form, large, and well fortified both by nature and art. It has a fine citadel called the *Brille*, erected by a biſhop named *Bernard van Galen* in order to awe the burghers. The dean and chapter now elect the biſhop; but till the beginning of the 13th century he was nominated by the emperor. This city has been rendered famous by three remarkable tranſactions. 1. By the peace concluded here in 1648, which put an end to a war of 30 years; occaſioned by the perſecuting ſpirit of bigotted papiſts, who choſe rather to plunge their country into all the calamities of war than allow liberty of conſcience to the Proteſtants. By this peace, how-

ever, they consented, much against their inclinations, to grant them a toleration. 2. By the disorders and disturbances occasioned here in 1553, by a parcel of enthusiasts, headed by a taylor called *John of Leyden* from the place of his birth, who turned out the magistrates, and took possession of the city, where they perpetrated the most horrid villanies and cruelties. 3. For the noble, though unsuccessful, efforts it made in defence of its liberties against the tyranny and usurpation of the above-mentioned turbulent and bloody-minded bishop, Bernard van Galen. In this city are a great number of convents and other religious houses, many of them stately piles, and surrounded with beautiful gardens.

MUNYCHIA, or *Munychius Portus*, (anc. geog.), a village and port of Athens, nearer to the city, less than, and fortified in the same manner with the Piræus, to the east of which it lay, or between it and the promontory Sunium, at the mouth of the Ilissus. Strabo says it was an eminence in form of a peninsula, at the foot of which stood three harbours, anciently encompassed with a wall, taking within its extent the Piræus and other harbours, full of docks, with the temple of Diana Munychia; taking its name from *Mynichus*, the founder of the temple.

MUNYCHIA, an anniversary solemnity observed at Athens, in honour of Diana, on the 16th of the month Munychion. Cakes were offered on the occasion called αμφιφωντες.

MUNYCHION, the tenth month of the Athenian year, containing 29 days, and answering to the latter part of our March and the beginning of April. It was so called from the festival Munychia, which was observed in this month. See MONTH and MUNYCHIA.

MUPHTI. See MUFTI.

MURÆNA, or EEL, in ichthyology; a genus of fishes, belonging to the order of apodes. The head is smooth; there are ten rays in the membrane of the gills; the eyes are covered with a common skin; and the body is cylindrical and slimy. There are seven species, distinguished by their fins, tails, &c. The most remarkable are,

1. The *anguilla*, or common eel, is very frequent in all our fresh waters, ponds, ditches, and rivers: according to Mr Pennant, it is the most universal of fish; yet is scarce ever found in the Danube, though very common in the lakes and rivers of Upper Austria.

The eel is very singular in many things relating to its natural history, and in some respects borders on the nature of the reptile tribe. It is known to quit its element, and during night to wander along the meadows, not only in order to change its habitation, but also for the sake of prey, feeding on snails as it passes along. During winter it beds itself deep in the mud, and continues in a state like the serpent-kind. It is very impatient of cold, and will eagerly take shelter in a wisp of straw flung into a pond in severe weather, which has sometimes been practised as a method of taking them. Albertus affirms, that he has known eels to take shelter in a hay-rick; yet all perished through excess of cold. It has been observed in a river of England called the *Nyne*, there is a variety of small eel, with a lesser head and narrower mouth than the common kind, that is found in clusters in the bottom of the river, and is called the *bed-eel:* these are sometimes roused up by the violent floods, and are never found at that time with meat in their stomach.

Eels are extremely voracious, and destructive to the fry of others. No fish lives so long out of water as the eel; and it is so extremely tenacious of life, that its parts will move a considerable time after they are flayed and cut in pieces. They vary much in their colours, from a sooty hue to a light olive green; and those which are called *silver eels* have their bellies white, and a remarkable clearness throughout. Besides these, there is a variety of this fish known in the river Thames by the name of *grigs*, and about Oxford by that of *grigs* or *gluts*. These are scarce ever seen near Oxford in the winter; but appear in spring, and bite readily at the hook, which common eels in that neighbourhood will not. They have a larger head, a blunter nose, thicker skin, and less fat, than the common sort; neither are they so much esteemed, nor do they often exceed three or four pounds in weight.—Common eels grow to a large size, sometimes weighing 15 or 20 pounds; but that is extremely rare. Mr Dale indeed, in the Philosophical Transactions, and some others, bring instances of ells much exceeding that size; but Mr Pennant suspects them to have been congers, since the enormous fish they describe have all been taken at the mouths of the Thames or Medway. The Romans held eels very cheap, probably on account of their likeness to snakes. On the contrary, the luxurious Sybarites were so fond of these fish, as to exempt from tribute of every kind those persons who sold them.

There is scarce any animal the generation of which has puzzled the learned more than this. Aristotle first broached an opinion that eels were of no sex, nor did propagate their species like other animals, but were equivocally gendered of the mud; and as wild and absurd a system as this is, there have not been wanting many, even in these latter and more enlightened times, who have given into it. But there is now no room to doubt that all animals are produced by the copulation of parents like themselves; and the finding of eels in new ponds is easily accounted for from the above mentioned circumstance of their migration. Dr Plot, and many others, have given accounts of whole droves of them leaving one ditch or pond to go to another.

Though the learned world at this time generally allows that eels are produced like other animals, by parents of their own kind, yet there remain many doubts about the manner in which the generation is performed. Some allow the eels to be, like the generality of other animals, of different sexes in the different individuals; and others affirm that they are all hermaphrodites, each having the parts of generation of both sexes. Rondeletius affirms that they are of both sexes; and Mr Allan, who has given a very curious paper concerning them in the Philosophical Transactions, is of the same opinion; and both say, that the parts of the sexes may be discovered on a careful inspection; and some are found to be males, and others females; but these parts are, in both sexes, they say, buried in a large quantity of fat; and they are of opinion, that hence proceeded the mistake of Aristotle and his followers, who, not being able to find those parts, concluded that they did not exist at all. Among those who allow the eel to be produced, like other animals, from animal-parents which have the sexes, some are of opinion that they are viviparous,

and

Muræna.

and others that they are oviparous: but Mr Chartwynd feems to have determined this controverfy by obferving, that if the aperture under the belly of the eel, which looks red in the month of May, be cut open at that time, the young eels will be feen to come forth alive after the operation. Mr Lewenhoeck fays, that he found an uterus in every eel he examined; and therefore concludes, that they are hermaphrodites: and he fuppofes that they have no male parts of generation like thofe of other animals; but that the office of thefe is performed by a liquor analogous to the male feed of animals, which is contained in certain glands, fituated in the infide of the uterus itfelf.

Eels have fometimes been met with in recent ponds, made at fuch a diftance from any other water that we cannot reafonably fuppofe them to have migrated thither over land. But in thefe cafes there is reafon to believe, that the ponds have been fupplied with them by the aquatic fowl of prey, in the fame manner as vegetation is fpread by many of the land-birds, either by being dropped, as they carry them to feed their young, or by paffing quick through their bodies, as is the cafe with herons.

2. The *conger*, or conger-eel, grows to a vaft fize. Dr Borlafe informs us, that they are fometimes taken near Mount's-bay of 100 lb. weight; and Mr Pennant affures us, that he has heard of fome taken near Scarborough that were 10 feet and a half long, and 18 inches in circumference in the thickeft part. They differ from the common eel in the following particulars: 1. Their colour in general is more dark. 2. Their eyes much larger in proportion.—3. The irides of a bright filvery colour. 4. The lower jaw is rather fhorter than the upper. 5. The infide-line is broad, whitifh, and marked with a row of fmall fpots. 6. The edges of the dorfal and anal fins are black. 7. They have more bones than the common eel, efpecially along the back quite to the head. 8. They grow to a much larger fize.

Congers are extremely voracious, preying on other fifh, and on crabs at the time they have loft their fhell and are in a foft ftate. They and eels in general are alfo particularly fond of carcafes of any kind, being frequently found lodged in fuch as are accidentally taken up.

The conger eels probably generate like the frefh-water fpecies. Innumerable quantities of what are fuppofed to be their fry come up the Severn about the month of April, preceding the fhads, which it is conjectured migrate into that river to feed on them: they are called *elvers*. They fwarm during their feafon, and are taken in a kind of fieve made of hair-cloth fixed to a long pole; the fifherman ftanding on the edge of the water during the tide, puts in his net as far as he can reach, and drawing it out again, takes multitudes at every fweep, and will take as many during one tide as will fill a bufhel. They are dreffed, and reckoned very delicate.

Thefe fifh are an article of commerce in Cornwall; numbers are taken on that coaft, and exported to Spain and Portugal, particularly to Barcelona.—Some are taken by a fingle hook and line, but (becaufe that way is tedious, and does not anfwer the expence of time and labour) they are chiefly caught by *bulters*, which are ftrong lines 500 feet long, with 60 hooks, each eight feet afunder, baited with pilchards or mackarel; the bulters are funk to the ground by a ftone faftened to them: fometimes fuch a number of thefe are tied together as to reach a mile. The fifhermen are very fearful of a large conger, left it fhould endanger their legs by clinging round them; they therefore kill them as foon as poffible by ftriking them on the navel. They are afterwards cured in this manner: They are flit, and hung on a frame till they dry, having a confiderable quantity of fat, which it is neceffary fhould exfude before they are fit for ufe. It is remarkable that a conger of 100 weight will wafte by drying to 24 lb.; the people therefore prefer the fmalleft, poffibly becaufe they are fooneft cured. During the procefs there is a confiderable ftench; and it is faid, that in the fifhing villages the poultry are fed with the maggots that drop from the fifh. The Portuguefe and Spaniards ufe thofe dried congers after they have been ground into a powder, to thicken and give a relifh to their foups. They are fold for about 40 fhillings the quintal, which weighs 126 lb. A fifhery of congers, fays Mr Pennant, would be of great advantage to the inhabitants of the Hebrides. Perhaps they would at firft undertake it with repugnancy, from their abfurd averfion to the eel kind.

Muræna.

3. The *firen*, or mud-iguana, a fingular animal, firft obferved by Dr Garden of Charleftown, and afterwards defcribed by Mr Ellis in the Philofophical Tranfactions for 1766. It has gills, fins, and two feet; and is in length from 31 to 40 inches. It is an inhabitant of South Carolina, where it is found in fwampy and muddy places, by the fides of pools, and under the trunks of old trees that hang over the water, and feeds on ferpents. The feet appear like little arms and hands, each furnifhed with four fingers, and each finger with a claw. "The head is fomething like an eel, but more compreffed; the eyes are fmall, and placed as thofe of the eel are. This fmallnefs of the eye beft fuits an animal that lives fo much in mud. The noftrils are very plainly to be diftinguifhed; thefe, with the gills, and remarkable length of the lungs, fhow it to be a true amphibious animal.—The mouth is fmall in proportion to the length of the body; but its palate and infide of the lower jaw are well provided with many rows of pointed teeth: with this provifion of nature, added to the fharp exterior bony edges of both the upper and under jaw, the animal feems capable of biting and grinding the hardeft kind of food. The fkin, which is black and full of fmall fcales, refembles fhagreen. Thefe fcales are of different fizes and fhapes, according to their fituation; but all appear funk into its gelatinous furface: thofe along the back and belly are of an oblong oval form, and clofe fet together; in the other parts they are round, and more diftinct. Both the parts are mottled with fmall white fpots, and have two diftinct lines compofed of fmall white ftreaks continued along from the feet to the tail. The fin of the tail has no rays, and is no more than an adipofe membrane like that of the eel."

Dr Garden, in a letter to Mr Ellis, mentions a remarkable property of this animal, which is, that his fervant endeavouring to kill one of them by dafhing it

Mural || Muranum. Plate CCCXV.

it againſt the ſtones, it broke into three or four pieces. Linnæus, from the deſcriptions ſent him, made it a new genus named *Syren*, of a new order *Meantes*, of the claſs amphibia. But from this claſs both the order *Meantes* and that of *Nantes* have been lately expunged; and Gmelin has reduced the ſyren to a ſpecies of the preſent genus. Its place here, however, ſeems ſtill of doubtful propriety; as Gmelin himſelf acknowledges in the Preface to his edition of the Syſtema Naturæ. For Campfer, having lately * had an opportunity to diſſect the ſyren, has diſcovered, that on each ſide of the head it is furniſhed with three true gills, ſeparated from each other by membranes having tooth-like appendages; that the mouth is armed with ſtrong and firmly planted teeth; that the heart has only one ventricle; and that the abdomen is filled with very long and capacious inteſtines: From all theſe circumſtances, he concludes, that this animal ought to be conſidered as a fiſh of the order *Branchioſtegi*;—while in other reſpects it is more nearly allied to the genus *Muræna*, of the order *Apodes*; although it differs materially from the other ſpecies of that genus, by having only three notched bones in the gills, and from the pectoral fins being each divided into four finger-like appendages.

* *Kerr's Tranſlation.*

MURAL, ſomething belonging to a wall; which the Latins call *murus*.

Mural-Crown, among the ancient Romans. See Crown.

Mural-Arch, is a wall, or walled arch, placed exactly in the plane of the meridian, *i. e.* upon the meridian line, for the fixing of a large quadrant, ſextant, or other inſtrument, to obſerve the meridian altitudes, &c. of the heavenly bodies.

Tycho Brahe was the firſt who uſed a mural arch in his obſervations; after him Hevelius, Mr Flamſtead, De la Hire, &c. uſed the ſame means. See Astronomy.

MURALT (N— de), a native of Switzerland, travelled through a great part of Europe with the views of a philoſopher. He publiſhed a collection of *Lettres ſur les François et ſur les Anglois*, 12mo, 2 vols. 1726, which met with great ſucceſs, though they are written in a vague and ſuperficial manner. Some other works which he publiſhed are below mediocrity. He died about the year 1750.

MURANT (Emanuel), a much-admired landſcape painter, was born at Amſterdam in 1622. He had the happineſs to be a diſciple of Philip Wouwermans, from whom he acquired that warmth and brilliancy of colouring, and that exquiſite pencil, which have rendered him deſervedly eminent. His ſubjects were views in Holland, villages, towns, cities, ruins of houſes, and decayed caſtles; all of them exactly ſketched after nature, and ſo exquiſitely finiſhed, that every minute part of a building was perfectly diſcernible, and even every particular ſtone or brick might be counted by the aſſiſtance of a convex glaſs. But this demanded ſo much patience and time, that it was impoſſible for him to paint many pictures; and on that account they are exceedingly ſcarce, and ſold for ſuch prices as muſt place them out of the reach of all ordinary purchaſers. He died in 1700.

MURANUM, (anc. geog.), a town on the confines of Lucania. Now *Morano*; a citadel in the Calabria Citra, at the ſprings of the Sybaris, midway between the Sinus Tarentinus to the eaſt, and the Tuſcan ſea to the weſt. Suppoſed to have ariſen from the ruins of Syphæum, a town of the Bruttii mentioned by Livy.

Muratori, Murcia.

MURATORI (Lewis Anthony), a learned and celebrated Italian writer, born at Vignoles, in the territory of Bologna, in 1672. He early diſcovered an extreme fondneſs for the learned languages and ſciences; and this was ſeconded by an excellent education. After having completed his firſt ſtudies, he embraced the ſtate of an eccleſiaſtic; and applied himſelf to polite literature, philoſophy, theology, civil law, antiquities, and other ſciences; by which means he became in a manner univerſally learned. He was ſcarce 22 years of age when he was made librarian of the Ambroſian library at Milan. In 1700 the duke of Modena, his ſovereign, recalled him, and made him his librarian, and keeper of the archives of his duchy. Muratori diſcharged this double employment during the reſt of his life, and had no other benefice than the provoſtſhip of Santa Maria del Pompoſa. He acquired the eſteem of the learned throughout Europe, who had recourſe to him for the lights they wanted. He became an aſſociate to the Academies of the Arcades of Rome, Della Cruſca, and Colomberia of Florence, the Academy of Etruſca at Cortona, the Royal Society of London, and of the Imperial Academy of Olmutz; and died in 1750. He wrote a great number of learned works; the principal of which are,—1. *Anecdota*, or a collection of pieces taken from the Ambroſian library, 2 vols 4to, with learned notes and diſſertations. 2. A treatiſe on the perfection of the Italian poetry, 2 vols 4to. 3. *Anecdota Græca*, 3 vols 4to. 4. A genealogical hiſtory of the houſe of Modena, 2 vols folio. 5. An excellent collection of the writers of the Italian hiſtory, 27 vols folio, with learned notes. 6. Another collection, under the title of *Antiquitates Italicæ*. 7. A collection of ancient inſcriptions, under the title of *Novus Theſaurus*, 6 vols folio. 8. The annals of Italy, 12 vols 4to, in Italian, &c. 9. Letters, diſſertations, Italian poems, &c.

MURCIA, the Pagan goddeſs of idleneſs.—The name is taken from *murcus* or *murcidus*, an obſolete word, ſignifying a dull, ſlothful, or lazy perſon.—The ſtatues of this goddeſs were always covered with duſt and moſs, to expreſs her idleneſs and negligence. She had a temple in Rome, at the foot of the Aventine mount.

Murcia, a kingdom in Spain, bounded on the north by New Caſtile, on the eaſt by the kingdom of Valencia, on the weſt by Andaluſia and Granada, and on the ſouth by the Mediterranean Sea. It is about 62 miles in length, and 58 in breadth; and its principal river is Segura. The ſoil is dry, becauſe it ſeldom rains, and therefore it produces little corn or wine; but there is plenty of oranges, citrons, lemons, olives, almonds, mulberries, rice, pulſe, and ſugar. It has alſo a great deal of ſilk. It was taken from the Moors in 1265. The air is very healthful.

Murcia, a large, handſome, and populous town of Spain, capital of a kingdom of the ſame name. It is a biſhop's ſee, and contains ſix pariſhes. The cathedral is a moſt ſuperb edifice, with the ſtairs of the ſteeple ſo contrived that a man may ride up to the top,

Murder.

top, either on horseback or in a coach. It is situated in a pleasant plain, which abounds in fine gardens about the city, in which are the best fruits in Spain. It is seated on the river Segura, in W. Long. 0. 36. N. Lat. 37. 48.

MURDER, or MURTHER, the act of killing another with violence and injustice. The word comes from the Saxon *morth* "death;" which some will have to signify a violent death; whence the barbarous Latin *murdrum* and *mordrum*.

Among the number of popular errors, is the notion which has obtained, that the dead body would bleed in the presence or upon the touch of the murderer.

The crime of murder is punished with death in almost all nations.

MURDER, or *Murther*, in law, is thus defined, or rather described, by Sir Edward Coke: "When a person, of sound memory and discretion, unlawfully killeth any reasonable creature in being, and under the king's peace, with malice aforethought, either express or implied." The best way of examining the nature of this crime will be by considering the several branches of this definition.

1. It must be committed by a person *of sound memory and discretion*: for lunatics or infants are incapable of committing any crime; unless in such cases where they show a consciousness of doing wrong, and of course a discretion or discernment between good and evil.

2. Next, it happens when a person of such sound discretion *unlawfully killeth*. The unlawfulness arises from the killing without warrant or excuse: and there must also be an actual killing to constitute murther; for a bare assault, with intent to kill, is only a great misdemesnor, though formerly it was held to be murder. The killing may be by poisoning, striking, starving, drowning, and a thousand other forms of death, by which human nature may be overcome. Of these the most detestable of all is poison; because it can of all others be the least prevented, either by manhood or forethought. And therefore, by the stat. 22 Hen. VIII. c. 9. it was made treason, and a more grievous and lingering kind of death was inflicted on it than the common law allowed; namely, *boiling to death*: but this act did not live long, being repealed by 1 Edw. VI. c. 12. There was also, by the ancient common law, one species of killing held to be murder, which may be dubious at this day, as there hath not been an instance wherein it has been held to be murder for many ages past, viz. bearing false witness against another, with an express premeditated design to take away his life, so as the innocent person be condemned and executed. The Gothic laws punished in this case both the judge, the witnesses, and the prosecutor; and, among the Romans, the *lex Cornelia de ficcariis*, punished the false witness with death, as being guilty of a species of assassination. And there is no doubt but this is equally murder *in foro conscientiæ* as killing with a sword; though the modern law (to avoid the danger of deterring witnesses from giving evidence upon capital prosecutions, if it must be at the peril of their own lives) has not yet punished it as such. If a man, however, does such an act, of which the probable consequence may be, and eventually is, death; such killing may be murder, although no stroke be struck by himself, and no killing may be primarily intended: as was the case of the unnatural son who exposed his sick father to the air against his will, by reason whereof he died; and of the harlot, who laid her child under leaves in an orchard, where a kite struck it, and killed it. So too, if a man hath a beast that is used to do mischief; and he, knowing it, *suffers* it to go abroad, and it kills a man; even this is manslaughter in the owner: but if he had purposely *turned it loose*, though barely to frighten people, and make what is called *sport*, it is with us (as in the Jewish law) as much murder as if he had incited a bear or a dog to worry them. If a physician or surgeon gives his patient a potion or plaster to cure him, which, contrary to expectation, kills him, this is neither murder nor manslaughter, but misadventure; and he shall not be punished criminally, however liable he might formerly have been to a civil action for neglect or ignorance: but it hath been holden, that if it be not a *regular* physician or surgeon who administers the medicine, or performs the operation, it is manslaughter at the least. Yet Sir Matthew Hale very justly questions the law of this determination; since physic and salves were in use before licensed physicians and surgeons: wherefore he treats this doctrine as apocryphal, and fitted only to gratify and flatter licentiates and doctors in physic; though it may be of use to make people cautious and wary how they meddle too much in so dangerous an employment. In order also to make the killing murder, it is requisite that the party die within a year and a day after the stroke received, or cause of death administered; in the computation of which the whole day upon which the hurt was done shall be reckoned the first.

Blackst. Comment.

3. Farther: The person killed must be "*a reasonable creature in being, and under the king's peace*," at the time of the killing. Therefore to kill an alien, a Jew, or an outlaw, who are all under the king's peace or protection, is as much murder as to kill the most regular-born Englishman; except he be an alien-enemy, in time of war. To kill a child in its mother's womb, is now no murder, but a great misprision: but if the child be born alive, and dieth by reason of the potion or bruises it received in the womb, it seems, by the better opinion, to be murder in such as administered or gave them. As to the murder of bastard-children, see BASTARD.

4. Lastly, the killing must be committed "*with malice aforethought*," to make it the crime of murder. This is the grand criterion which now distinguishes murder from other killing: and this malice prepense, *malitia præcogitata*, is not so properly spite or malevolence to the deceased in particular, as any evil design in general; the dictate of a wicked, depraved, and malignant heart; *un disposition a faire un male chose*: and it may be either *express*, or *implied*, in law. Express malice is when one, with a sedate deliberate mind and formed design, doth kill another: which formed design is evidenced by external circumstances discovering that inward intention; as lying in wait, antecedent menaces, former grudges, and concerted schemes to do him some bodily harm. This takes in the case of deliberate duelling, where both parties meet avowedly with an intent to murder: thinking it their duty, as gentlemen, and claiming it as their right, to wanton with-

Murder. with their own lives and thofe of their fellow-creatures; without any warrant or authority from any power either divine or human, but in direct contradiction to the laws both of God and man: and therefore the law has juftly fixed the crime and punifhment of murder on them, and on their feconds alfo. Yet it requires fuch a degree of paffive valour to combat the dread of even undeferved contempt, arifing from the falfe notions of honour too generally received in Europe, that the ftrongeft prohibitions and penalties of the law will never be entirely effectual to eradicate this unhappy cuftom, till a method be found out of compelling the original aggreffor to make fome other fatisfaction to the affronted party, which the world fhall efteem equally reputable as that which is now given at the hazard of the life and fortune, as well of the perfon infulted, as of him who hath given the infult. Alfo, if even upon a fudden provocation one beats another, in a cruel and unufual manner, fo that he dies, though he did not intend his death, yet he is guilty of murder by exprefs malice; i. e. by an exprefs evil defign, the genuine fenfe of *malitia*. As when a park-keeper tied a boy that was ftealing wood to a horfe's tail, and dragged him along the park; when a mafter corrected his fervant with an iron bar, and a fchoolmafter ftamped on his fcholar's belly, fo that each of the fufferers died; thefe were juftly held to be murders, becaufe the correction being exceffive, and fuch as could not proceed but from a bad heart, it was equivalent to a deliberate act of flaughter. Neither fhall he be guilty of a lefs crime who kills another in confequence of fuch a wilful act as fhows him to be an enemy to all mankind in general; as going deliberately, and with an intent to do mifchief, upon a horfe ufed to ftrike, or coolly difcharging a gun among a multitude of people. So if a man refolves to kill the next man he meets, and does kill him, it is murder, although he knew him not; for this is univerfal malice. And if two or more come together to do an unlawful act againft the king's peace, of which the probable confequence might be bloodfhed; as to beat a man, to commit a riot, or to rob a park, and one of them kills a man; it is murder in them all, becaufe of the unlawful act, the *malitia præcogitata*, or evil intended beforehand.

Alfo in many cafes where no malice is expreffed, the law will imply it: as, where a man wilfully poifons another, in fuch a deliberate act the law prefumes malice, though no particular enmity can be proved. And if a man kills another fuddenly, without any, or without a confiderable provocation, the law implies malice; for no perfon, unlefs of an abandoned heart, would be guilty of fuch an act upon a flight or no apparent caufe. No affront, by words or geftures only, is a fufficient provocation, fo as to excufe or extenuate fuch acts of violence as manifeftly endanger the life of another. But if the perfon fo provoked had unfortunately killed the other, by beating him in fuch a manner as showed only an intent to chaftife and not to kill him, the law fo far confiders the provocation of contumelious behaviour, as to adjudge it only manflaughter, and not murder. In like manner, if one kills an officer of juftice, either civil or criminal, in the execution of his duty, or any of his affiftants endeavouring to conferve the peace, or any private perfon endeavouring to fupprefs an affray or apprehend a felon, knowing his authority or the intention with which he interpofes, the law will imply malice, and the killer fhall be guilty of murder. And if one intends to do another felony, and undefignedly kills a man, this is alfo murder. Thus if one fhoots at A and miffes him, but kills B, this is murder; becaufe of the previous felonious intent, which the law transfers from one to the other. The fame is the cafe, where one lays poifon for A, and B, againft whom the prifoner had no malicious intent, takes it, and it kills him; this is likewife murder. So alfo, if one gives a woman with child a medicine to procure abortion, and it operates fo violently as to kill the woman, this is murder in the perfon who gave it. It were endlefs to go through all the cafes of homicide, which have been adjudged, either exprefsly or impliedly, malicious: thefe therefore may fuffice as a fpecimen; and we may take it for a general rule, that all homicide is malicious, and of courfe amounts to murder, unlefs where juftified by the command or permiffion of the law; excufed on a principle of accident or felf-prefervation; or alleviated into manflaughter, by being either the involuntary confequence of fome act, not ftrictly lawful, or (if voluntary) occafioned by fome fudden and fufficiently violent provocation. And all thefe circumftances of juftification, excufe, or alleviation, it is incumbent upon the prifoner to make out, to the fatisfaction of the court and jury: the latter of whom are to decide whether the circumftances alleged are proved to have actually exifted; the former, how far they extend to take away or mitigate the guilt. For all homicide is prefumed to be malicious, until the contrary appeareth upon evidence.

The punifhment of murder, and that of man-flaughter, were formerly one and the fame; both having the benefit of clergy: fo that none but unlearned perfons, who leaft knew the guilt of it, were put to death for this enormous crime. But now, by feveral ftatutes, the benefit of clergy is taken away from murderers through malice prepenfe, their abettors, procurers, and counfellors. In atrocious cafes it was frequently ufual for the court to direct the murderer, after execution, to be hung upon a gibbet in chains near the place where the fact was committed; but this was no part of the legal judgement; and the like is ftill fometimes practifed in the cafe of notorious thieves. This, being quite contrary to the exprefs command of the Mofaical law, feems to have been borrowed from the civil law; which, befides the terror of the example, gives alfo another reafon for this practice, viz. that it is a comfortable fight to the relations and friends of the deceafed. But now, in England, it is enacted by ftatute 25 Geo. II. c. 37. that the judge, before whom any perfon is found guilty of wilful murder, fhall pronounce fentence immediately after conviction, unlefs he fees caufe to poftpone it; and fhall in paffing fentence direct him to be executed on the next day but one (unlefs the fame fhall be Sunday, and then on the Monday following), and that his body be delivered to the furgeons to be diffected and anatomized; and that the judge may direct his body to be afterwards hung in chains, but in nowife to be buried without diffection. And, during the fhort but awful interval between fentence and execution, the prifoner

shall be kept alone, and sustained with only bread and water. But a power is allowed to the judge, upon good and sufficient cause, to respite the execution, and relax the other restraints of this act. See farther, PARRICIDE, and *PETIT Treason*.

MURDERERS, or *Murdering Pieces*, in a ship, are small pieces of ordnance, either of brass or iron, which have chambers put in at their breeches. They are used at the bulk-heads of the fore-castle, half-deck, or steerage, in order to clear the deck, on the ship's being boarded by an enemy.

MURENA. See MURÆNA.

MURENGERS, two officers of great antiquity in the city of Chester, annually chosen out of the aldermen, to see that the walls are kept in repair, and to receive a certain toll and custom for the maintenance thereof.

MURET (Mark Anthony Francis), in Latin *Muretus*, was born at Muret, near Limoges, in 1526. He acquired a perfect knowledge of the Greek and Latin tongues without any instructor, and became one of the most learned men of his time. After having taught some time in Provence, he was made a professor at Paris in the same college with Turnebus and Buchanan. In 1554 he went into Italy; and in 1563 was professor of law, philosophy, and history, at Rome, where he died in 1585. His principal works are, 1. Excellent notes on Terence, Horace, Catullus, Tacitus, Cicero, Sallust, Aristotle, Xenophon, &c. 2. *Orationes*. 3. *Variæ Lectiones, Poemata, Hymni Sacri*. 4. *Disputationes in Lib. I. Pandectorum, de Origine Juris, &c.* 5. *Epistolæ, Juvenilia Carmina, &c.* Most of Muret's works have been printed in the Venice edition of 1737, in 5 vols 8vo.

MUREX, in zoology, a genus of insects belonging to the order of vermes testacea. This animal is of the snail-kind: the shell consists of one spiral valve, rough, with membranaceous furrows; and the aperture terminates in an entire canal, either straight, or somewhat ascending. There are 60 species, particularly distinguished by peculiarities in their shells, &c.

From a species of murex was obtained the famous Tyrian dye so much valued by the ancients. This, however, has long been superseded by the use of the cochineal. One of the shells producing the dye was a kind of buccinum; but the finest, or Tyrian purple, was got from the murex. These species of shells are found in various parts of the Mediterranean. Immense heaps of them are to be seen about Tarentum to this day, evincing one place where this precious liquor was extracted. See Plate CCCXXII.

In the accounts of a Spanish philosopher it is mentioned, that on the coasts of Guayaquil and Guatimala in Peru the murex is also found. The shell which contains it adheres to the rocks that are washed by the sea: it is of the size of a large walnut. The liquor may be extracted two ways: some kill the animal after they have drawn it out of the shell; then press it with a knife from head to tail; separate from the body the part where the liquor is collected, and throw away the rest. When this operation, after being repeated on several snails, has afforded a certain quantity of fluid, the thread intended to be dyed is dipped in it, and the process is finished. The colour, which is at first of the whiteness of milk, becomes afterwards green, and is not purple till the thread is dry. Those who disapprove of this method, draw the fish partly out of the shell, and, squeezing it, make it yield a fluid which serves for dyeing: they repeat this operation four times at different intervals, but always with less success. If they continue it, the fish dies. No colour at present known, says the Abbé Raynal, can be compared to this, either as to lustre, liveliness, or duration. It succeeds better on cotton than wool, linen, or silk.

MUREX, a caltrap or iron instrument, with sharp points projecting in every direction, used by the Romans as a defence against the enemy's horse. It was so called, probably, because the points bore some resemblance to the spines and tubercles with which the shell of the fish murex is surrounded.

MURGI, or MURGIS (anc. geog.), the last town of Baetica, next the Tarraconensis: the Urce of Ptolemy. Now *Muxara*, a port-town of Granada, on the Mediterranean. W. Long. 1° 50'. N. Lat. 37° 6'.

MURIA, alimentary salt. See SALT.

MURINA, or MURINES, a delicious sweet wine, medicated with spices, and the usual drink of the ladies of antiquity.

MURILLO (Bartholomew-Stephen), a celebrated painter, was born at Pilas near Seville, in 1613. Having shown a very early inclination to painting, he was instructed by his uncle John del Castillo, an artist of some note, whose subjects were fairs and markets; in which style Murillo painted several pictures while he continued with that master: but his principal knowledge in the art was derived from Velasquez, who directed his studies, and frequently retouched his designs. Many writers assert, that he studied at Rome, and improved himself excessively in that city. But Velasco, a Spanish author, affirms that he never was in Italy; but arrived at the excellence he possessed by copying the works of Titian, Rubens, and Vandyck, which were at Madrid, and the Escurial; and also by studying after the antique statues, which are in the Royal collections. However, he became an excellent painter, and was employed by the king of Spain to execute several historical pictures, which raised his reputation through every province of his own country. Those paintings being afterwards sent to Rome as a present to the pope, the Italians were so much pleased with his performances, that they called him a second Paul Veronese. In Spain he designed and finished several grand altar-pieces, for the churches and convents at Madrid, Seville, Cordova, Cadiz, and Granada; and some of his compositions are in the churches of Flanders. But notwithstanding his genius, taste, and abilities, qualified him to execute subjects of history with general applause; yet his favourite subjects were beggar-boys, as large as life, in different actions and amusements; which he usually designed after nature, and gave them a strong and good expression. His original pictures of those subjects have true merit, and are much esteemed, many of them being admitted into the most capital collections of the English nobility; but of those, there are abundance of copies, which, to the dishonour of the artist, are sold as originals to injudicious purchasers. He died in 1685.

MURRAIN, or GARGLE, a contagious disease among cattle. The symptoms are, a hanging down and

Murray.

and ſwelling of the head, abundance of gum in the eyes, rattling in the throat, a ſhort breath, palpitation at the heart, ſtaggering, a hot breath, and a ſhining tongue. In order to prevent this diſeaſe, the cattle ſhould ſtand cool in ſummer, and have plenty of good water: all carrion ſhould be ſpeedily buried; and as the feeding of cattle in wet places, on rotten graſs and hay, often occaſions this diſeaſe, dry and ſweet fodder ſhould be given them.

MURRAY, a county of Scotland, extending by the coaſt from the river Spey on the eaſt to Beauly on the weſt, which is the boundary of the province of Roſs. It ſends two members to parliament, and is an earldom in a branch of the Stuart family.

According to the account of the reverend Mr Shaw miniſter of Elgin, in anſwer to ſome queries of Mr Pennant, the country produces wheat, barely, oats, rye, peaſe, and beans. Of theſe, in plentiful years, upwards of 20,000 bolls are exported, beſides ſerving the county itſelf and ſome of the Highland counties. Some hemp is alſo cultivated, and a great deal of flax; of which linen is made, not only for home-couſumption, but a conſiderable quantity of linen-yarn is exported. Great quantities of potatoes are alſo cultivated. Several hundreds of black cattle are alſo exported from the Highlands of Murray, but few or none from the Lowlands.—Peculiar to this province is a kind of wood, called *red ſaugh*, or *ſallow*; which is no leſs beautiful than mahogany. It is much more firm and tough than mahogany, and reſembles the lighter-coloured kind of that wood. It receives a fine poliſh, but is very ſcarce, growing on rocks. But there are great foreſts of firs and birches, which our author thinks are the remains of the Sylva Caledonia. Here alſo is found a remarkable root, called by the natives *carmele*: it grows in heaths and birch-woods to the bigneſs of a large nut; and ſometimes there are four or five roots joined together by fibres. It has a green ſtalk and ſmall red flowers. Dido, ſpeaking of the Caledonians, ſays, *Certum cibi genus parant ad omnia, quem ſi ceperint quantum eſt unius fabæ magnitudo, minime eſurire aut ſitire ſolent.* Cæſar alſo tells us of a root called *chara*, which his ſoldiers mixed with milk and made into bread when in want of proviſion, which greatly relieved them. This root, Mr Shaw thinks, is the ſame with the *carmele* or *ſweet root* of Murray. He informs us, that he hath often ſeen it dried, and kept for journeys through hills where no proviſion was to be had: he has likewiſe ſeen it pounded and infuſed; the liquor makes a more agreeable and wholeſome liquor than mead. It grows in ſuch plenty, that a cart-load of it can eaſily be gathered.

Murray is interſected by the rivers Spey, Loſſey, Findern, Nairn, Neſs, and Beauly. The river of Spey, riſing on the borders of Lochaber, is more than 60 Scots, or 100 Engliſh miles long, but too rapid to be navigable. Upon this river great floats of fir and birch-wood are carried down to the Frith; the float is guided by a man ſitting on a *courach*. This veſſel is of an oval ſhape, about four feet long and three broad; a ſmall keel from head to ſtern; a few ribs croſs the keel, and a ring of pliable wood round the lip of it; the whole covered with the rough hide of an ox or horſe. The rower ſits on a tranſverſe ſeat in the middle, and holds in his hand a rope, the end of which is tied to the float, and with the other hand he manages a paddle, keeps the float in deep water, and brings it to ſhore when he pleaſes. In this province, alſo, is Loch Neſs, remarkable for its never freezing. There are many other lakes in this country, of which one called *Dundelchack* is remarkable in that it is never covered with ice before the month of January; but after that time one night's ſtrong froſt covers it all over. On the eaſt ſide of Loch Neſs, a large mile above the loch, is the waterfall of Foher, where the river *Feach-Len* falls over a ſteep rock about 80 feet high; and a thick fog riſes from the place where it falls, occaſioned by the violent daſhing of the water. There is a conſiderable ſalmon-fiſhery on the rivers Spey, Findern, Neſs, and Beauly, which ſerves the towns and country, beſides exporting to the value of 12,000l. annually.

Murray, Murrhine.

There are many natural caves in the hills of this country, which formerly were the receptacles of thieves and robbers, and now afford ſhelter to hunters and ſhepherds in ſtormy weather. The moſt remarkable mountain is Carngern in Strathſpey. In it are found a particular kind of ſtones well known to the lapidaries. They are of blue, green, yellow, and amber colours; ſome ſo large as to make ſnuff-boxes, or ſmall cups; ſome of hexagonal or pentagonal figures, and tapering to a point at each end. The mountain of Benalar, in Badenoch, is by Mr Shaw reckoned to be the higheſt land in Scotland, as waters flowing from it fall into the ſea at Dundee, Inverlochy, and Garmoch in Murray.

MURRHINE, MURRHINUS, Μορρινος, in antiquity, an appellation given to a delicate ſort of ware brought from the eaſt, whereof cups and vaſes were made, which added not a little to the ſplendor of the Roman banquets.

Critics are divided concerning the matter of the pocula, or vaſa murrhina, murrina, or murrea. Some will have them to have been the ſame with our porcelain or china-ware.

The generality hold them to have been made of ſome precious kind of ſtone, which was found chiefly, as Pliny tells us, in Parthia, but more eſpecially in Carmania. Arrian tells us, that there was a great quantity of them made at Dioſpolis in Egypt. This he calls another ſort of murrhina work; and it is evident, from all accounts, that the murrhina of Dioſpolis was a ſort of glaſs-ware, made in imitation of the porcelain or murrha of India. There is ſome difference in the accounts given by Pliny and Martial of the murrhina vaſa. The firſt author ſays, that they would not bear hot liquors, but that only cold ones were drank out of them. The latter, on the other hand, tells us, that they bore hot liquors very well. If we credit Pliny's account, their porcelain was much inferior to our's in this particular. Some conjecture them to have been of agate, others of onyx, others of coral. Baronius, doubtleſs, was fartheſt out of the way, when he took them to be made of myrrh, congealed and hardened. Some have ſuppoſed theſe veſſels to be made of cryſtal; but this is contrary to the account of all the ancients. The Greeks had the words κρυσαλλος for cryſtal, and σμυρνε for myrrh, very common among them; and therefore, if theſe veſſels had been made of either of

Mus. of these substances, they would in some places have called them smyrna or crystallina. On the contrary, the most correct among them call them murrhina or morrina. The cups made of crystal, which were also in use at those times, were called crystallina, and these murrhina or murrhæa, by way of keeping up the distinction; and Martial tells us, that the stone they were made of was spotted or variegated, calling them pocula maculosæ murræ. And Statius mentions the crystalline and murrhine cups in the same sentence, but as different things, not the same. Arrian mentions also the λιθος μορρια; which his interpreters censure as an error of the copies, and would alter into myrrha, the name of the gum myrrh.

Pompey is recorded as the first who brought these murrhine vessels out of the east, which he exhibited in his triumph, and dedicated to Jupiter Capitolinus. But private persons were not long without them. So fond, in effect, did the Roman gentry grow of them, that a cup which held three sextaries was sold for 70 talents. T. Petronius, before his death, to spite Nero (or as Pliny expresses it, *ut mensam ejus exhæredaret*, to disinherit his table), broke a bason, *trulla murrhina*, valued at 300 talents, on which that emperor had set his heart.

MUS, in zoology: A genus of quadrupeds belonging to the order of *Glires;* the characters of which are these: The upper foreteeth are wedge-shaped; there are three grinders, sometimes (though rarely) only two, on each side of the jaws; and the clavicles or collar-bones are complete. In the new edition of the *Systema Naturæ*, by Dr Gmelin, the numerous species of this genus have been distributed into different groupes or divisions, distinguished by some particular character common to the individuals of each.— The first division consists of,

I. Myocastores, or *Beaver-rats*, the individuals of which have the tail *flattened* laterally at the end.

1. The coypus, or webbed beaver-rat, has a thick hairy tail of a moderate length, and the hind-feet webbed. It is an inhabitant of Chili, where it frequents the water. It has a strong resemblance, both in colour and shape, to the otter; but is allied to the murine tribe by the number and arrangement of its teeth.

2. The zibethicus, or musquash, with a long sharp-pointed tail, and the feet not webbed. This has been already described under the article Castor, of which it was ranked as a species in the former editions of Linnæus. In fact, it does resemble the beaver in the form of the body and flat scaly tail, as well as in its manners and economy. In size, however, and length of tail, it comes nearer to the brown rat; but in its general appearance, and in the short hairy ears, it resembles the water-rat.

II. Mures, or *Rats* and *Mice;* having *round* tails, some naked and some hairy.

1. The piloris, or musk cavy, with a naked tail blunt at the end, and covered with scales. There are two varieties: one with the body of an uniform whitish colour; the other with the upper parts tawny, and the under parts white. The former inhabits Ceylon, and the latter the West Indies. They are nearly of the size of a rabbit: they both burrow in the ground; sometimes infest houses like the rat; and have a strong flavour of musk.

2. The caraco has a naked tail, long, scaly, and somewhat blunt; the body is of a brown grey colour, and the hind feet are very slightly webbed. It inhabits the eastern parts of Siberia, and probably Chinese Tartary and the northern provinces of China; burrowing like the rabbit, near the banks of rivers.— It swims remarkably well, and even infests houses.— The body and head are six inches in length, and the tail four and a half. Mus. Plate CCCXIX. fig. 10.

3. The americanus, or American rat, has a long, naked, and scaly tail; the head is long-shaped, with a narrow pointed nose, the upper jaw being much longer than the lower; the ears are large and naked. It is larger than the black, and smaller than the brown rat; its colour is of a deep brown, inclining to ash on the belly, and the fur is coarse and harsh. It is probably this species which is said (Kalm's Trav. ii. 48.) to live among the stones and clefts of rocks, in the blue mountains of Virginia, at a distance from the peopled part of the country, which comes out only at night, and makes a terrible noise.

4. The decumanus, or brown rat, has a long, naked, scaly tail; the upper parts of the body are of a light brown, mixed with tawny and ash colour, the lower parts dirty white. The head and body measure about nine inches; and the length of the tail, which consists of 200 rings, is seven and a half. The whiskers are larger than the head; and the eyes are large, black, and prominent. The fore-feet have four toes, with a small claw in place of the fifth or thumb. It inhabits India and Persia, and has only been known in Europe in the present century. They dwell in burrows which they dig in the banks of rivers; and frequent towns, aqueducts, drains, necessaries, stables, barns, gardens, fields, and houses. They swim and dive with great dexterity; feed on vegetables, grain, fruits, and even destroy poultry; and are hunted eagerly by cats, dogs, and ferrets. They lay up stores of acorns, beech-mast, and other provisions, in their holes; in which the males remain during winter, except in fine weather, without hybernating; but the females and their young live mostly in barns and out-houses in that season. They often emigrate from one place to another in great companies. The female produces three times in the year, having 12 or 15, even 18 or 19, at a litter. The bite of this creature is not only severe but dangerous, the wound being immediately attended with great swelling, and is a long time in healing. These animals are so bold as to turn upon those who pursue them, and fasten on the stick or hand of such as offer to strike them. This species is supposed to be the mus caspicus of Ælian †, which he says was nearly as large as the ichneumon, and made periodical visits in vast multitudes to the countries which border on the Caspian, swimming boldly over the rivers, holding by each others tails. Plate CCCXVIII. fig. 5.

† *Hist.* c. 17.

5. The rattus, black or common rat, has an almost naked scaly tail, which is very small, has 250 distinct rings, and is eight inches long. The head and body measure seven inches in length; the upper parts are deep black grey, and the under parts ash coloured. There are four toes, and a small claw in place of the fifth, on each fore foot, and five on the hind feet. This species inhabits India, Persia, and Europe except its most northern parts; from hence it has been carried Fig 11.

Mus.

to Africa and America; and is frequent in Otaheite, though lefs common in the other iflands of the fouthern ocean. Of late years it has greatly diminifhed in Europe, and is even in many places extirpated, in confequence of the introduction of the brown fpecies, which deftroy the black rats; though little is gained by the exchange, the brown having the fame difpofitions, with greater ftrength and abilities for doing mifchief. It is the moft pernicious of any of our fmaller quadrupeds. Meat, corn, paper, cloaths, furniture, in fhort every convenience of life, is a prey to this deftructive creature. Nor are its devaftations confined to thefe: for it will make equal havock among poultry, rabbits, or young game; nay, it has been known to gnaw the extremities of infants when afleep. It is a domeftic animal, refiding very frequently in houfes, barns, or granaries; and it is furnifhed with fore teeth of fuch ftrength as enable it to force its way through the hardeft wood or the oldeft mortar. It makes a lodge either for its days refidence, or a neft for its young, near a chimney; and improves the warmth of it, by forming there a magazine of wool, bits of cloth, hay, or ftraw. It lodges alfo in cielings, and in the void fpaces between the wall and the wainfcotting. From thefe lurking-places the rats iffue in queft of food, and tranfport thither every fubftance they can drag, forming confiderable magazines, efpecially when they have young to provide for. The female has ten teats, and brings forth feveral times in a year, but always in the fummer feafon. The litter generally confifts of five or fix; and in fpite of poifon, traps, and cats, they thus multiply to fuch a degree as fometimes to do a great deal of damage. In old country-houfes where grain is kept, and where the vicinity of barns and magazines facilitates their retreats, they often increafe fo prodigioufly, that the poffeffors are obliged to remove and defert their habitations, unlefs the rats happen to deftroy each other; an event which frequently takes place, for thefe creatures when pinched for food devour each other. When a famine happens by reafon of too many being crowded into one place, the ftrong kill the weak, open their heads, and firft eat the brain and then the reft of the body. Next day the war is renewed, and continues in the fame manner till moft of them are deftroyed; which is the reafon why thefe animals, after being extremely troublefome for fome time, difappear all of a fudden, and do not return for a long time. Rats are extremely lafcivious; they fqueak during their amours, and cry when they fight. They foon learn their young to eat; and when they begin to iffue from the hole, their mother watches, defends, and even fights with the cats, in order to fave them. A large rat is more mifchievous than a young cat, and nearly as ftrong: the rat ufes her fore-teeth; and the cat makes moft ufe of her claws; fo that the latter requires both to be vigorous, and accuftomed to fight, in order to deftroy her adverfary. The weafel, though fmaller, is a much more dangerous and formidable enemy to the rat, becaufe he can follow it into its retreat. Their ftrength being nearly equal, the combat often continues for a long time, but the method of ufing their arms is very different. The rat wounds only by reiterated ftrokes with his fore-teeth, which are better formed for gnawing than biting; and being fituated at the extremity of the lever or jaw, they have not much force. But the weafel bites cruelly with the whole jaw; and inftead of letting go its hold, fucks the blood from the wounded part, fo that the rat is always killed.—The rat was firft introduced into America by the Europeans in 1544, and is now the peft of all that continent. In the neighbourhood of the lower parts of the river Volga, there is a fmall variety of this fpecies found in the deferts, which does not weigh above fix or feven drams.

6. The mufculus, or common moufe, has a very long, fcaly, and almoft naked tail: the fore feet have each four toes; the hind feet five, the fifth or thumb having no claw: the head and body meafure three inches and a half in length; the upper parts are tawny, and the lower parts whitifh or afh-coloured. This little animal, which inhabits all parts of the world, lives almoft entirely in houfes, and follows mankind for the fake of their provifions. It feeds on almoft every thing, fuch as grain, bread, cheefe, butter, oil, and every kind of food ufed by mankind, and drinks little: it is of mild and gentle manners, exceedingly timid, and very quick in all its motions. The moufe never iffues from his hole but in queft of food, and runs in again upon the leaft alarm. It goes not, like the rat, from houfe to houfe, unlefs forced, and is not near fo deftructive. It is alfo capable of being tamed to a certain degree, though not fo perfectly as other animals. It has many enemies, from whom it can efcape only by its agility and minutenefs. Owls, birds of prey, cats, weafels, hedge-hogs, and even rats, make war upon the mice, fo that they are deftroyed by millions; yet the fpecies ftill fubfifts by its amazing fecundity. They bring forth at all feafons, and feveral times in the year: the litter generally confifts of five or fix; and in lefs than 15 days the young difperfe, and are able to provide for themfelves. Ariftotle tells us, that having fhut up a pregnant moufe in a veffel, along with plenty of grain, he found in a fhort time after 120 mice, all fprung from the fame mother. Plate CCCXVIII. fig. 2.

Several varieties of mice as to colour are found, fome being altogether black, fome yellowifh, fome fpotted with white, fome of a white colour with afh-coloured fpots, and the moft beautiful of all, and the leaft common, are entirely white, with red eyes: but as thefe agree in every other circumftance, it is unneceffary to defcribe them more at large.

7. The fylvaticus, or long-tailed field-moufe, is larger than the common moufe, meafuring from the end of the nofe to the fetting on of the tail four inches and an half, the tail four inches; the upper parts of the body are of a yellowifh brown; the breaft is yellow, and the belly white; the tail is covered with fhort hair. The fore feet have four toes each; the hind feet five. Thefe animals are found in fields, gardens, and fhrubberies. In fome places they are called *bean-mice*, from the havock they make among beans when firft fown. They feed alfo on nuts, acorns, and grain, of which they amafs quantities, not proportioned to their wants, but to the capacity of the place where it is depofited, infomuch that a fingle animal will collect more than a bufhel. Thus they provide for other animals as well as themfelves: the hog comes in for a fhare; and the great damage done Fig. 6.

to

Mus. to the fields by thefe creatures, in rooting up the ground, is chiefly owing to their fearch after the concealed hoards of the field-mice. M. Buffon informs us, that he has often feen great damage done to the plantations by the field-mice. They carry off the new fown acorns; by following the furrow of the plough, they dig up one after another, not leaving a fingle feed. This happens chiefly in thofe feafons when the acorns are fcarce: not finding a fufficient quantity in the woods, they come in queft of them in the cultivated fields, and often carry off fuch quantities that they corrupt in their magazines. Thefe creatures, according to the fame author, do more mifchief in a nurfery of trees than all the birds and other animals put together. The only way to prevent this damage is to lay traps at ten paces afunder, through the extent of the fown field. No other apparatus is neceffary than a roafted walnut placed under a flat ftone, fupported by a ftick. The animals come to eat the walnut, which they prefer to acorns; and as it is fixed to the ftick, whenever they touch it, the ftone falls down and crufhes them to death. The fame expedient M. Buffon alfo made ufe of with fuccefs againft the fhort-tailed field-moufe, which alfo deftroys acorns. In this way he found that upwards of 100 were taken each day, from a piece of ground confifting only of about 40 French arpents. From the 15th of November to the 8th of December, above 2000 were caught in this manner. Their numbers gradually diminifhed till the froft became fevere, which is the time they retire into their holes to feed on their magazines. In autumn they are moft numerous; for if provifions fail during the winter they devour one another. The long-tailed mice eat alfo the fhort tailed fpecies, and even thrufhes, blackbirds, &c. which they find entangled in fnares. They firft eat the brain, and then the reft of the body. M. Buffon once kept a dozen of thefe mice in a cage, and furnifhed them with food every morning at eight o'clock. One day they were neglected for about a quarter of an hour, when one of their number was eaten up by the reft; next day another fuffered the fame fate; and in a few days only one remained: all the others had been killed, and partly devoured; and even the furvivor himfelf had his feet and tail mutilated. Thefe animals are very prolific, producing more than once a-year, and bringing nine or ten at a birth. They generally make the neft for their young very near the furface, and often in a thick tuft of grafs. During winter they frequent barns, ftables, and out-houfes.

8. The mefforius, harveft moufe, or lefs long-tailed field moufe, is a very fmall fpecies, or perhaps rather a variety of the former; and inhabits Hampfhire, where it is very numerous, particularly during harveft. They form their neft above the ground, between the ftraws of the ftanding corn, and fometimes in thiftles: it is of a round fhape, and compofed of the blades of corn. They bring about eight young ones at a time. Thefe never enter houfes; but are often carried, in the fheaves of corn, into ricks: and 100 of them have frequently been found in a fingle rick on pulling it down to be houfed. Thofe that are not thus carried away in the fheaves, fhelter themfelves during winter under ground, and burrow deep, forming a warm bed for themfelves of dead grafs. They are the fmalleft of the Britifh quadrupeds: the length from nofe to tail is only two inches and a half; their tail two inches, and the weight one-fixth of an ounce. They are more flender than the other long-tailed field-moufe; and their back of a fuller red, inclining to the colour of a dormoufe. Mus.

9. The agrarius, or ruftic moufe, is about three inches long, and fcarcely weighs half an ounce; the tail is only about half the length of the body and head; the upper part of the body is of a yellowifh colour, with a dark line along the back; the belly and the legs are white; the head is oblong, with a fharp nofe, and fmall ears lined with fur; the hind legs have each a dufky circle juft above the foot. It inhabits Ruffia, and is found in Silefia, rarely in Germany. This fpecies is migratory; and wanders about often in vaft multitudes, doing immenfe injury to the corn: It burrows in the ground, forming a long gallery juft below the furface, and a little elevated, leading to a larger chamber, in which confiderable quantities of grain and feeds are ftored up for winter provifion. Plate CCCXIX. fig. 5.

10. The minutus, or minute moufe, has the upper parts of the body of a deep tawny or ferruginous colour, and the under parts whitifh. It is about half the fize of the common moufe, the tail being fcarcely two inches long; the female is fmaller than the male, and lefs elegant in her colours; the nofe is fomewhat fharp; the face is dufky, with fome whitenefs at the corners of the mouth; the ears are fmall, and almoft hid in the fur; the feet are grey. This fpecies inhabits Ruffia; where it is found in the corn-fields and in barns, and is plentiful in birch woods: it feems to wander about without any fixed places for its neft; and much greater numbers of males are found than of females. Fig. 1.

11. The vagus, or wandering moufe, is between two and three inches long: the colour of the upper parts of the body is a pale afh, waved with black, and having a black line along the middle of the back; the ears are large, oval, naked, and plaited. The legs are very flender, and the feet whitifh, having four toes and a conical excrefcence before, and five behind, all armed with long claws; the tail is longer than the body, very flender, prehenfile at the end, of an afh colour above and whitifh below; the head is oblong, with a blunt nofe reddifh at the tip, having yellow fore-teeth, and only two grinders on each fide in the upper jaw. The female has eight teats.—This fpecies inhabits the deferts of Tartary and Siberia, as high as the Ural, Irtifh, Oby, and Jenifei. Is frequent in the birch woods, and lives in fiffures of rocks, under ftones, and in hollows of trees; feeding chiefly on feeds, and likewife on fmall animals of the fame genus. It wanders about in great flocks, migrating from one place to another in the night; hybernates during winter, and is of a very chilly nature, fo as even to become torpid and fall afleep, in a round form, in the cold nights of the month of June. It has carnivorous inclinations. Fig. 9.

12. The betulinus, or beech-moufe, has a confiderable refemblance to the wandering moufe, but is fomewhat fmaller. The upper parts of the body are tawny, with a black line along the back, the under parts whitifh or pale afh-colour; the nofe is fharp, with Fig. 15.

Mus. with a red tip; the ears are ſmall, oval, plaited, brown, and briſtly at the ends; the limbs are very ſlender, with long and very ſeparable toes; the tail is ſlender and much longer than the body. This ſpecies inhabits the birch woods in the deſert plains of Iſchim and Baraba, and between the Oby and Jeniſei. It lives ſolitary, frequenting the hollows of decayed trees. It runs up trees readily, and faſtens on their branches with its tail; and by means of its ſlender fingers or toes, it can faſten even to a very ſmooth ſurface. It is a very tender animal, ſoon growing torpid in cold weather; and its voice is very weak.

Plate CCCXVIII fig. 15. 13. The pumilio, or dwarf mouſe, is of a browniſh aſh colour, with the fore-head and nape of the neck black, and having four black lines along the back meeting at the tail. It is ſcarcely two inches long, the tail is about two-thirds of the length of the body, and the whole animal, even when ſteeped many months in ſpirits, hardly weighs four ſcruples. The body is ſomewhat flattened; the regions of the eyes, the ears, and the noſe, are of a paler colour than the reſt of the body; all the feet have five toes, the thumb or inner toe of the fore feet being very ſmall, but diſtinctly furniſhed with a claw; the legs and feet are ſtrongly made; the tail is almoſt naked, and of a pale aſh-colour. This ſpecies, which was firſt deſcribed by Dr Sparrman, inhabits the foreſts of Sitſicamma near Ilangen river, 200 hours journey from the Cape of Good Hope.

Plate CCCXIX. fig. 16. 14. The ſaxatilis, or rock mouſe, is about four inches long, and weighs nearly nine drams; the tail is hairy, an inch and a half in length, of a brown colour above, and white beneath; the head is oblong, with a longiſh noſe, and oval downy ears, brown at the edges; the limbs are ſtrong; and the tail is thinly covered with hair; the upper parts of the body are of a brown colour, ſlightly mixed with yellowiſh or grey; the ſides are rather inclined to the latter colour; the belly is of a light aſh or whitiſh; the feet and legs are blackiſh; the ſnout is duſky, and ſurrounded with a ſlender white ring. This ſpecies is an inhabitant of the eaſtern parts of Siberia beyond lake Baikal, and of the deſerts of Mongul Tartary.—It burrows in the fiſſures of rocks, forming a winding oblique paſſage, which afterwards branches out into ſeveral others pointing downwards, and ending in a chamber, in which is a bed or neſt of ſoft herbs. It feeds chiefly on the ſeeds of the aſtragalus.

Plate CCCXVIII fig. 13. 15. The amphibious, or water-rat, with a long tail; the upper parts of the body being covered with black hair mixed with yellowiſh, and the under parts aſh-coloured; the ears ſcarcely appear above the fur; the feet have three toes on each, and the rudiments of a fourth. This ſpecies, of which there are ſeveral varieties, differing in the toes and in the colour, inhabits the whole of Europe, the northern parts of Aſia as far as the icy ſea, and North America.—They dwell chiefly near waters, forming burrows in their ſteep banks; about ponds and wet ditches; likewiſe in marſhy places, meadows, and gardens; feeding on roots, herbs, and ſhrubs; and on frogs, craw-fiſh, inſects, ſmall fiſh, and the fry of larger ones. They ſwim and dive with great facility, and live much in the water. They are very fierce, and bite bitterly. The fleſh of theſe animals is reckoned very delicate by ſome of the more ſavage inhabitants of the Ruſſian empire; and is eaten by the French along with that of the otter during lent. The female is ſmaller than the male, and has a greater yellowneſs of colour; ſhe has eight teats, four of which are placed on the breaſt and four on the belly. They procreate about the end of winter, at which time they ſmell ſtrongly of muſk, and produce as far as eight young ones in the month of April.

16. The alliarius, or garlic mouſe, has a ſhort tail; the ears rather large, and ſomewhat hairy; the body aſh coloured on its upper parts, and whitiſh underneath. The head and body meaſure ſomewhat more than four inches, the tail ſcarcely an inch and a half. This ſpecies inhabits Siberia, about the rivers Jeniſei, Kan, Lena, and Angara; and feeds on the roots of garlic, of which it lays up large ſtores in ſubterraneous burrows. Plate CCCXIX. fig. 2.

17. The rutilus, or red mouſe, has a ſhort tail; the ears are longer than the fur, which is tawny red on the back, light grey and yellow on the ſides, and whitiſh on the belly. The head and body meaſure about four inches, and the tail one.—This ſpecies inhabits Siberia, from the Oby as far as Kamtſchatka, and within the Arctic circle. It lives in holes and in hollows of trees; feeding on grain, and ſometimes on animals of the ſame genus. It comes often into houſes and barns, eating almoſt of every thing which comes in its way, but is particularly fond of fleſh. It is very lively, and runs about even on the ſnow the whole winter. Fig. 8.

18. The arvalis, or meadow-mouſe, is from three to ſix inches long, the female being much longer than the male, and the tail is little more than an inch: the head is large, with a blunt noſe, ſhort ears almoſt hid in the fur, and prominent eyes; the upper parts of the body are of a mixed ferruginous and black colour; the belly is deep aſh, and the legs and feet duſky;—the tail is terminated by a ſmall tuft of hair. There is a variety which is almoſt black.—This ſpecies inhabits all Europe, Siberia, Hircania, and Newfoundland; dwelling in buſhy places, corn-fields, meadows, and gardens, chiefly near waters; living on grain, nuts, acorns, and walnuts, which it collects into ſubterraneous burrows: but it appears to prefer corn to every other food. When the grain is ripe, they aſſemble from all quarters, and often do great damage by cutting the ſtalks of corn in order to come at the ears. They follow the reapers, and eat up all the fallen and neglected grain. When the gleanings are devoured, they flock to the new-ſown fields, and deſtroy the crop of the enſuing year. In winter moſt of them retire into the woods, where they feed upon filberts, acorns, and the ſeeds of trees. In particular years they appear in numbers ſo immenſe, that they would deſtroy every thing if they continued long: but they always kill and eat one another during a ſcarcity of proviſions. They beſides are devoured by the long-tailed field-mice, by foxes, wild-cats, and weaſels. Theſe creatures are often carried home in the ſheaves of corn, and 100 of them have been found in houſing a rick. In ſuch caſes it has been obſerved, that the dogs devoured all the mice of this ſort they could find, rejecting the common kind; and, on the contrary, the cats would touch none but the laſt. The female produces ſeveral Plate CCCXVIII fig. 8.

Mus. feveral times a year, and brings from eight to twelve young at a birth: it has a ftrong affection for them; one that was feduced into a wire-trap by placing its brood in it, was fo intent on foftering them, that it appeared quite regardlefs of its captivity. In Newfoundland, thefe mice are very deftructive to gardens; but feldom do much damage in this way in Britain.

Plate CCCXIX. fig. 13. 19. The focialis, or focial moufe, with a very fhort flender tail, and naked, rounded, and very fhort ears; the fore feet have each three toes and the rudiments of a fourth; the upper parts of the body are light-grey; the fides, fhoulders, and belly, are white. The head and body are fomewhat more than three inches long, the tail half an inch. This fpecies inhabits the fandy deferts between the Volga and Ural, near the Cafpian fea, and in the mountains of Hircania.—They live in pairs, or in families, confifting of a male and a female with their young ones; and of thefe families vaft numbers live together, the whole country being covered with little hills of earth thrown out of their burrows. They feed moftly on tulip roots; and are preyed on by weafels, polecats, crows, and otters. They fwarm chiefly in fpring, and rarely appear in autumn, at which feafon it is fuppofed they migrate, or take fhelter among the bufhes.

Fig. 12. 20. The œconomous, or economic moufe, in its general form, refembles the meadow-moufe; but the body is rather longer and the belly larger. The ears are naked and hid in the fur; the colour is tawny; and the fore-feet have each three toes with the rudiments of a fourth. The head and body meafure four inches and a quarter, the tail fomewhat more than an inch. This fpecies inhabits Siberia, from the river Irtifh eaftwards, in Kamtfchatka, and under the Arctic circle. They are called by Dr Pallas *mures œconomi*, from their curious way of living. They dwell moftly in damp foils, forming burrows, with many chambers and numerous entrances, immediately under the turf. In thefe they lay up magazines of various vegetable food, chiefly bulbous roots; which they fpread out in funny days to dry, and never touch them but in winter, living all fummer on berries and other vegetables. The Kamtfchatkans hold thefe animals in great regard, and never deftroy their hoards; they take away only part, and leave fome caviare or other fubftance to fupport them in its ftead. This fpecies fometimes emigrates in vaft multitudes, keeping a ftraight courfe, like the lemmus, even over rivers; and are much infefted on their march by birds, fifh, wild hogs, foxes, and other wild beafts. They begin their march from about the river Pengin in fpring, and about the middle of July reach Ochotfka and Judoma, at a vaft diftance; and return in October. The Kamtfchatkans are much alarmed at their migrations, which portend rainy weather and a bad chace; and when they find them lying weak and fpent with fatigue after croffing a river, give them every affiftance in their power. The Tfchutfki are not fo much attached to this animal, and make ufe both of their winter ftores and of their carcafes as food.

21. The gregalis, or gregarious moufe, has a fhort tail; the ears are longer than the fur; the fore-feet have each three toes and the rudiments of a fourth; the fur is dark afh-coloured on the upper parts, and whitifh below. This fpecies is lefs than the economic moufe, and longer than the focial; the female being five inches long and the male four. It inhabits the eaftern parts of Siberia, where it dwells in arid places, forming burrows with numerous openings directly under the fod; thefe lead to chambers in which it lays up large ftores of roots, efpecially thofe of the lilium pomponii and garlic: It eats fitting up.

22. The laniger, or woolly moufe, with woolly fur of an afh-colour, inhabits Peru and the north parts of Chili. It burrows in the earth, is very docile and cleanly, and is eafily tamed; it lives on bulbous roots, efpecially onions; the female breeds twice a-year, and brings five or fix young ones at each litter. It is about fix inches long, with a fhort nofe, and fmall fharp-pointed ears; the fur is very long and exceedingly fine, almoft like the threads of a fpider's web, and was formerly employed as the very fineft fpecies of wool by the Peruvians.

23. The lagurus or rambling moufe, has hardly any tail; the ears are fhorter than the fur; the fore-feet have each three toes, and the rudiments of a fourth; the upper parts of the body are afh-coloured mixed with dufky, and having a black line along the back. The head is long, with rough and fwelling lips; the limbs are fhort and flender; and the length of the body and head is between three and four inches. This fpecies inhabits the defarts near the rivers Ural, Irtifh, and Jenifei.—Each individual forms a round neft of dried grafs in a burrow, having an oblique and a perpendicular entrance. They feed chiefly on the dwarf iris; but eat all kinds of grain, and devour other fpecies of this genus, as well as one another. They fleep very much, in a rolled-up form, and are very flow in their motions, like the marmot; but do not become torpid in winter. This fpecies is very falacious; the males fight together for the females, and the conqueror generally devours the vanquifhed. The female fmells of mufk when in feafon, produces feveral times in the year, and brings five or fix young ones at a birth. They migrate in great troops; whence the name of rambling mice, which is given them by the Tartars. Fig. 17.

24. The torquatus, collared or ringed moufe, has a very fhort tail, with a tuft of hard briftles at the end, which is blunt: the ears are fhorter than the fur; the feet have each five toes; the fur is ferruginous, varied with grey, yellow, and dufky, having a whitifh collar round the neck, and a dark line along the back. The head and body are fomewhat more than three inches long, the tail fcarcely one inch. It inhabits the northern parts of the Uralian mountains, and the marfhes near the frozen ocean; feeding chiefly on the lichen rangiferinus, lichen nivalis, and polygonus viviparus; thefe articles of food are ftored up in burrows having numerous paffages, which it digs under the turfy foil. This fpecies is migratory, and refembles the lemmus in its manners. Fig. 4.

25. The lemmus, or lemming, has a very fhort tail: The head is pointed, having very long whifkers, fix of the hairs on each fide being longer and ftronger than the reft; the mouth is fmall, having two very long fore-teeth in each jaw, and the upper lip is divided; the eyes are fmall and black; the ears are fhorter than the fur, rounded, and reclined backwards; the fore-legs are very fhort, having four flender hairy toes Plate CCCXVI. fig. 2.

Mus. toes on each, and a long ſharp claw like a cock's ſpur in place of the fifth or thumb; the hind-feet have five toes; the ſkin is very thin, and the upper parts of the body are black and tawny, diſpoſed in irregular blotches; the belly is white tinged with yellow. The length from noſe to tail is about five inches; of the tail, half an inch. This ſingular animal inhabits the mountains of Norway and Lapland. They feed on graſs, the catkins of the dwarf birch, the lichen rangiferinus, or rein-deer liverwort, and other ſuch vegetable productions: in ſummer they form ſhallow burrows under the turf, and in winter they make ſimilar long paſſages under the ſnow in queſt of food; for as they do not lay up magazines, and do not hybernate, they are obliged to ſearch for proviſions in the rigorous winter of theſe northern climes. When they foreſee, by ſome wonderful inſtinct of nature, the approach of a very ſevere winter, they leave their northern haunts in autumn, and emigrate in immenſe multitudes into the lower parts of Norway and Sweden, keeping a ſtraight line in ſpite of every obſtacle, moving moſtly in the night-time, and making prodigious havock of every vegetable they are able to reach. In this journey, which takes place at uncertain intervals, though generally about every ten years, they are deſtroyed by eagles, hawks, foxes, and other animals of prey, and numbers are drowned in paſſing rivers or lakes, which never interrupt their courſe, even proceeding on into the ſea: from all theſe concurring cauſes very few live to return to their native mountains, and thus a check is put to their ravages, as it takes years to repair their numbers ſufficiently for another invaſion. They are bold and fierce, ſo as even to attack men and animals, if they meet them in their courſe; and bite ſo hard as to allow themſelves to be carried a conſiderable way, hanging by their teeth to a ſtick, before they will quit their hold. The female breeds ſeveral times in the year, producing five or ſix young at a birth: ſometimes they bring forth during their migration, when they carry their young in their mouth or on their back.

There is a variety, the Sibiricus, or Siberian lemming, of a ſmaller ſize, and more uniform tawny colour, than the above. It inhabits the northern parts of the Uralian chain of mountains, and on the river Oby. It differs greatly in manners from the former: for it lays up in its burrows large ſtores of proviſions to ſerve during winter; whence it is probable that it does not migrate like the Norwegian kind.

There are nine or ten other ſpecies belonging to this diviſion.

III. Criceti, or *Hamſters*; having pouches on the cheeks, and ſhort hairy tails.

Plate CCCXIX. fig. 10. 1. The acredula, or Siberian hamſter, has large oblong oval furrowed ears: the upper parts of the body are of a yellowiſh and brown aſh-colour, the under parts hoary. The head and body meaſure four inches, and the tail near one. This ſpecies inhabits the diſtrict of Orenburgh in Siberia, near the Yaik or Ural. It lives in burrows, which it quits only in the night to ſeek for food: The Coſſacks ſay that it migrates out of the deſarts in vaſt multitudes; but Dr Pallas ſuſpects this to be a miſtake.

Plate CCCXVIII fig. 1. 2. The M. cricetus Germanicus, or German hamſter, is the moſt deſtructive of the whole rat-tribe. The males are about ten inches long, and the tail about three, but the females are ſcarcely more than half ſo large: the former weigh from 12 to 16 ounces, while the latter ſeldom exceed from four to ſix ounces: The head is thick, with a blunt noſe, and numerous whiſkers, large full black eyes, and large rounded open ears; uſually the head and back are of a reddiſh brown colour, with red cheeks; the ſides are paler, with three white ſpots; the breaſt, upper part of the fore-legs, and belly, are black; the feet are large and white, having four toes, and a claw inſtead of a fifth toe on the fore-feet, and five toes on each hind foot: The colour varies; ſometimes, though rarely, they are found entirely white or yellowiſh, or white with black ſpots on the back; ſometimes the ſnout is white, and the forehead aſh-coloured, or the lower jaw of a white colour.—There is a variety (the black German hamſter) which is entirely black, excepting the tip of the noſe, edges of the ears, and the feet, which are white. Fig. 4. This ſpecies inhabits Siberia, the ſouth of Ruſſia, Poland, Sclavonia, Hungary, Sileſia, Bohemia, and Germany beyond the Rhine, eſpecially in Thuringia.—Each individual forms a ſubterraneous burrow, conſiſting of ſeveral chambers, with two holes or entrances leading from the ſurface; one of theſe is perpendicular, and the other, in which the excrements are lodged, is oblique; the holes of the females have ſeveral perpendicular openings, and each young one of her family is lodged in a ſeparate chamber: The chambers which are ſet apart for the lodging of themſelves and young are lined with ſtraw or graſs; the reſt are larger, and are appropriated for containing magazines of grain, beans, peaſe, lintſeed, vetches, and other ſuch ſeeds, each in a ſeparate cell. The chambers of the older animals are dug ſeveral feet deep, while thoſe of the younger ones ſeldom exceed a foot under the ſurface. The hamſter ſleeps during the winter like the marmots; when in a torpid ſtate, neither reſpiration nor any kind of feeling can be perceived. The heart, however, beats 15 times in a minute, which has been diſcovered by opening the cheſt. The blood continues to be fluid, but the inteſtines are not irritable; even an electrical ſhock does not awake him; but in the open air he never becomes torpid. When dug up in his ſtate of torpidity, the hamſter is found with his head bent under his belly between the two fore-legs, and thoſe behind reſt upon his muzzle. The eyes are ſhut; and when the eye-lids are forced open, they inſtantly cloſe again. The members are ſtiff, like thoſe of a dead animal, and the whole body feels as cold as ice. When diſſected during this ſtate, he ſeems to feel very little; ſometimes indeed he opens his mouth as if he wanted to reſpire; but his lethargy is too ſtrong to admit of his awakening entirely. This lethargy hath been aſcribed ſolely to a certain degree of cold; which indeed may be true with regard to dormice, bats, &c. But experience ſhows, that, in order to render the hamſter torpid, he muſt alſo be excluded from all communication with the external air: for when he is ſhut up in a cage filled with earth and ſtraw, and expoſed in winter to a degree of cold ſufficient to freeze the water, he never becomes torpid: but when the cage is ſunk four or five feet under ground, and well ſecured againſt the acceſs of the air, at the end of eight or ten days he is equally torpid as if

Mus. if he had been in his own burrow. If the cage is brought up to the furface, the hamfter will awake in a few hours, and refume his torpid ftate when put below the earth. The experiment may be repeated with the fame fuccefs as long as the froft continues. We have a farther proof that the abfence of the air is one of the caufes of torpidity in the hamfter; for when brought up from his hole in the coldeft weather, and expofed to the air, he infallibly awakes in a few hours. This experiment fucceeds as well in the night as in the day; which fhows that light has no fhare in producing the effect. It is curious to obferve the hamfter paffing from a torpid to an active ftate. He firft lofes the rigidity of his members, and then makes a profound refpiration, but at long intervals. His legs begin to move, he opens his mouth, and utters difagreeable and rattling founds. After continuing thefe operations for fome time, he opens his eyes, and endeavours to raife himfelf on his legs. But all thefe movements are ftill reeling and unfteady, like thofe of a man intoxicated with liquor. He, however, reiterates his efforts till he is enabled to ftand on his legs. In this attitude he remains fixed, as if he meant to reconnoitre and repofe himfelf after his fatigue; but he gradually begins to walk, eat, and act in his ufual manner. This paffage from a torpid to an active ftate requires more or lefs time, according to the temperature of the air. When expofed to a cold air, he fometimes requires more than two hours to awake; and in a more temperate air he accomplifhes his purpofe in lefs than one hour. It is probable that, when the hamfter is in his hole, this change is performed imperceptibly, and that he feels none of the inconveniences which arife from a fudden and forced revivifcence.

The hamfter is a very mifchievous animal; and fo exceedingly fierce, that he feems to have no other paffion but rage. In confequence of this, he attacks every other animal that comes in his way, without regarding the fuperior fize or ftrength of his antagonift; nay, as if he was ignorant of the method of faving himfelf by flight, he allows himfelf to be beat to pieces with a ftick rather than yield. If he feizes a man's hand, he muft be killed before he quits his hold. When the hamfter perceives a dog at a diftance, he begins with emptying his cheek-pouches if they happen to be filled with grain, and which are fo capacious as to hold a quarter of a pint Englifh. He then blows them up fo prodigioufly, that the fize of the head and neck greatly exceeds that of the body. Laftly, he raifes himfelf on his hind-legs, and in this attitude darts on his enemy. If he catches hold, he never quits it but with the lofs of life. But the dog generally feizes him behind, and ftrangles him. This ferocious temper prevents the hamfter from being at peace with any other animal. He even makes war againft his own fpecies, not excepting the females. When two hamfters encounter, they never fail to attack each other, and the ftronger always devours the weaker. A combat between a male and a female lafts longer than between two males. They begin by purfuing and biting each other; then each of them retires to a fide as if to take breath; a little after, they renew the combat, and continue to fly and fight till one of them falls. The vanquifhed uniformly ferves for a repaft to the conqueror.

The hamfters copulate about the end of April; Mus. when the males enter the apartments of the females, where they remain only a few days. If two males happen to meet in the fame hole, a furious combat enfues, which generally terminates in the death of the weakeft. The conqueror takes poffeffion of the female; and both, though at every other period they perfecute and kill each other, lay afide their natural ferocity during the few days their amours continue. They even mutually defend each other againft agreffors; and if a hole is opened about this time, the female defends her hufband with the utmoft fury. The females bring forth twice or thrice every year. Their litter is never fewer than fix, and more frequently from 16 to 18. Their growth is very rapid. At the age of 15 days they begin to dig the earth; and foon after, the mother banifhes them from her habitation; fo that at the age of about three weeks they are abandoned to their own management. The mother in general difcovers little affection for her offfpring; and when her hole is opened, flies in the moft daftardly manner, leaving her young ones to perifh. Her only folicitude at that time is to provide for her own defence. With this view fhe digs deeper into the earth, which fhe performs with amazing quicknefs. The young would willingly follow her; but fhe is deaf to their cries, and even fhuts the hole which fhe has made.

The hamfters feed upon all kinds of herbs, roots, and grains, which the different feafons produce, and even eat the flefh of fuch animals as they can conquer. They are particularly fond of places where liquorice grows, and feed much on its feeds. Their pace is very flow, and they do not climb; but they dig with vaft quicknefs, and will gnaw through a piece of wood an inch and a half thick in a very fhort time. As they are not adapted for long journeys, their magazines are firft ftocked with the provifions which are neareft their abode. This is the reafon why fome of the chambers are frequently filled with one kind of grain only. When the harveft is reaped, they go to a greater diftance in queft of provifions, and carry every article they can find, without diftinction, to their granary. To facilitate the tranfportation of their food, nature has furnifhed them with two pouches in the infide of each cheek. On the outfide, thefe pouches are membranous, fmooth, and fhining; and in the infide there are a great many glands, which fecrete a certain fluid, to preferve the flexibility of the parts, and to enable them to refift any accidents which may be occafioned by the roughnefs or fharpnefs of particular grains. Each of thefe receptacles is capable of containing an ounce and an half of grain, which, on his return to his lodgings, the animal empties, by preffing his two fore-feet againft his cheeks. When we meet a hamfter having his cheeks filled with provifions, it is eafy to feize him with the hand, without the rifk of being bitten; becaufe in this condition he has not the free motion of his jaws. But if he is allowed a little time, he foon empties his pouches, and ftands upon his defence. The quantity of provifions found in the holes depends on the age and fex of the inhabitant. The old hamfters frequently amafs 100 pounds of grain; but the young and the females content themfelves with a quantity much fmaller. Their object

object in laying up proviſions, is not to nouriſh them during winter, which they paſs in ſleep, and without eating; but to ſupport them after they awake in the ſpring, and previous to their falling into a torpid ſtate, which reſembles a profound ſleep. At the approach of winter, the hamſters retire into their ſubterraneous abodes; the entrance to which they ſhut up with great addreſs. Here the animal repoſes, in the ſituation already deſcribed, upon a bed of ſtraw, and in this ſtate he is commonly dug up. They are preyed on by polecats, weaſels, cats, dogs, foxes, and birds of prey; and are proſcribed by man, on account of their devaſtations. In winter the peaſants generally go a *hamſter-neſting* as they call it; the retreat is known by a ſmall eminence of earth raiſed near the oblique paſſage formerly deſcribed. The peaſants dig down till they diſcover the hoard, and are generally well paid for their trouble; as they often find two buſhels of corn, beſides the ſkins of the animals, which are valuable furs: and it is remarkable, that the hair ſticks ſo faſt to the ſkin, that it cannot be plucked off without the utmoſt difficulty. In ſome ſeaſons the hamſters are ſo numerous, that they occaſion a dearth of corn. In one year about 11,000 ſkins, in a ſecond 54,000, and in a third year 80,000, were brought to the town-houſe of Gotha, to receive a reward for their deſtruction. They are likewiſe deſtroyed by means of a paſte formed of honey and flour boiled up with arſenic or powdered hellebore.

Plate CCCXIX. fig. 11.

3. The arenarius, or ſand-hamſter, has the upper parts of the body hoary; the ſides, belly, limbs, and tail, pure white. It inhabits the ſandy deſarts of Baraba, on the river Irtiſh, in Siberia. The head is large, with a longiſh ſnout and a ſharp noſe, having very long whiſkers, very large pouches, and great oval browniſh ears; the body is ſhort and thick, being about four inches long, and the tail rather more than one; the fur is very ſoft; the fore feet have only four toes each, the hind feet five, all the claws being white. This animal is very fierce and untameable: it forms burrows, like the preceding ſpecies; is chiefly active at night, and feeds moſtly upon leguminous plants.

Fig. 7.

4. The ſongarus, or ſongar hamſter, has the upper parts of the body of a grey aſh-colour, marked with a black line along the back; the ſides of the head and body are varied with large white and dark brown ſpots; the feet and belly are white. It is about three inches long, with a very ſhort, thick, blunt, and hairy tail, little more than one-third of an inch in length. It inhabits the deſert of Baraba, near the Irtiſh, in Siberia; where, like its congeners, it digs chambers for the reception of proviſions. It is not, however, ſo fierce as ſome other ſpecies of the hamſters; but may be tamed when caught young, and grows very familiar.

There are two or three other ſpecies belonging to this diviſion.

Fig. 18.

5. The phæus, or rice-hamſter, has the upper parts of the body of a hoary aſh-colour, with long duſky hairs along the back; the ſides whitiſh; the circumference of the mouth, breaſt, belly, and extremities of the limbs, pure, white. It is about three inches and a half long, and the tail ſcarcely one inch.—This ſpecies inhabits about Zarizyn in the deſarts of Siberia, and in the mountains of the north of Perſia; where it does vaſt miſchief in the rice fields. It is often caught in traps during winter, near ſtables and other out-houſes, and never becomes torpid.

Fig. 14.

6. The furunculus, or Baraba hamſter, has the upper parts of the body of a cinereous yellow, with a black ſtreak on the back; the under parts dirty white. It is about three inches long, and the tail near one. This ſpecies inhabits Dauria, Siberia in the deſart of Baraba, towards the Ob, between the Onon and Argum, and in the Chineſe empire near lake Dalai; living chiefly on the ſeeds of the aſtragulus and atriplex: but its manners are unknown.

IV. Myotalpæ†, or *Mole-rats*. Theſe have no external ears, very ſmall eyes, and a very ſhort tail or none. They live entirely under ground like the moles.

† Kerr — *Mures ſubterranei*, *Gmelin*.

Plate CCCXIX. fig. 3.

1. The talpina, or Ruſſian mole-rat, is of a duſky colour; has a very ſhort tail, ſcarce appearing beyond the fur; and no external ears: the fore-teeth are long, extended from the mouth, and wedge-ſhaped: the eyes are very ſmall, and hid in the fur: the feet have five toes; the fore-feet are very ſtrong, flat, and formed for digging. It is about four inches long; and in the general form reſembles the water-rat. As to colour, the head, back, and ſides are duſky, and the belly and limbs white. There is a variety (the *nigra*), which is entirely black.—This ſpecies inhabits the plains of Ruſſia and Weſtern Siberia, ſcarcely extending beyond the Irtiſh, and never beyond the Oby. It is fond of a turfy ſoil, avoiding ſandy or muddy places; and digs holes like thoſe of the hamſter, which it lines with ſoft graſs, and fills with bulbous roots, throwing up hillocks of earth all along the tracks; each individual has its ſeparate burrow: It works only in the night, and ſeldom comes out except in the ſeaſon of love. Its ſight is very weak in the day-time. It feeds chiefly on the roots of tulips, tuberoſe lathyrus, and tuberoſe phlomis. It procreates about the beginning of April, at which time it ſmells ſtrongly of muſk; and the females produce three or four young at a litter.

Plate CCCXVIII. fig. 9.

2. The capenſis, or Cape mole-rat, is of a dark brown colour tinged yellowiſh, with the fore-part of the face, orbits, and regions of the ears, white: It has a very ſhort tail, and no external ears; and is about five inches and a half long. It inhabits the Cape of Good Hope, where it infeſts the gardens.

3. The maritima, or African mole-rat, is of a pale browniſh aſh-colour mixed with yellowiſh on the upper parts, the ſides and under parts paler: the tail is very ſhort; and there are no external ears. It inhabits the ſand hills adjacent to the ſea at the Cape of Good Hope; and reſembles the former ſpecies, but is much larger, meaſuring 12 or 13 inches long, and the head is more lengthened. It forms burrows in the ſand like thoſe of rabbits; and digs with ſurpriſing celerity. It runs ſlowly; but is very fierce, and bites ſeverely. It feeds chiefly on the roots of ixiæ, antholyzæ, gladioli, and irides; and is reckoned good eating.

Fig. 10.

4. The aſpalax, or Daurian mole-rat, is of a dirty yellow aſh-colour on the upper parts, and whitiſh aſh on the lower: has a very ſhort tail, and no external ears; the eyes are very ſmall, and deep-ſeated; the feet have each five toes, the claws of the fore feet being very long.—This ſpecies inhabits Dauria, and Siberia beyond the Irtiſh, between the Alei and Tſcharyſch rivers.

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rivers. It digs very long burrows in the black turfy soil or firm sand, throwing up numerous hillocks, which extend over a considerable surface; it works both with its feet and nose, and sometimes with its teeth. It feeds chiefly on the roots of bulbous plants. This species varies in size, those of Dauria being near nine inches long, while those farther east are scarcely six.

Plate CCCXVIII fig. 7.

5. The typhlus, or blind mole-rat, is of a reddish ash colour; and has no tail, external ears, or apparent eyes; the feet have each five toes; and the fore-teeth are broad. The body and head measure between seven and eight inches: the mouth is continually gaping, with short wrinkled fore-teeth above, and very long ones below, likewise furrowed or wrinkled, none of them being hid by the lips; the body is covered with short, soft, and close set fur, which is of a dusky colour at the bottom, with the ends of a rusty brown mixed with ash-colour; the legs are very short, having five toes on each foot armed with short claws, and slightly connected by a short membrane at their bases. This species inhabits the southern parts of Russia, from Poland to the Volga. Each individual forms burrows under the turfy soil of very considerable extent, with many lateral passages, and throws out the earth at different distances, in large hillocks sometimes two yards in circumference, and proportionally high. It works with its snout, feet, rump, and even with its teeth; and digs with great celerity, especially when frightened, in which case it digs directly downwards. When irritated, it snorts, gnashes its teeth, raises its head in a menacing posture, and bites with great severity. It feeds on roots, especially those of the bulbous chærophyllum. It is entirely blind, though it has the rudiments of very small eyes, which are covered over with a continuation of the skin; but it possesses the senses of touch and hearing in a very eminent degree, to make up for the loss of sight. It breeds in spring and summer; and the female, which has two teats, brings from two to four young ones at a birth.

The *Marmot*, *Agouti*, *Guinea-pig*, *Cavy*, *Jerboa*, *Dormouse*, &c. which were formerly comprehended under the present genus in the Linnæan arrangement, have, in consequence of more accurate investigation, been lately disjoined, and distributed under four new genera, *Myoxus*, *Arctomys*, *Dipus*, and *Cavia**. But as we are past the alphabetical order in which the three last of those genera should have been introduced, we must still describe the above animals (excepting the first) in this place; observing, however, to distinguish them according to their new generic arrangement.

* See Gmelin's edition of the *Systema Naturæ*; and the very elaborate and more ample edition in English, publishing by Kerr.

I. Myoxus, or *Dormouse*. See Myoxus, the *Marmot*.

II. Arctomys, the *Marmot*; the characters of which genus are: There are two wedge-like cutting teeth in each jaw; the grinders are five above, and four below, on each side; and there are perfect clavicles or collar-bones.

Plate CCCXVII. fig. 7.

1. The marmotta, or common marmot, has short round ears; gibbous cheeks; a short hairy tail; the upper parts of the body of a dusky brown colour, and the lower parts reddish. The body and head measure 16 inches, the tail six. This species inhabits the summits of the Alps and Pyrenean mountains, in dry places where there are no trees. It is more subject to be rendered torpid by cold than any other. In the end of September, or beginning of October, he retires into his hole, from which he comes not out till the beginning of April. His retreat is capacious, broader than long, and very deep, so that it can contain several marmots without any danger of corrupting the air. With their feet and claws, which are admirably adapted for the purpose, they dig the earth with surprising quickness, and throw it behind them. It is not a hole, or a straight or winding tube, but a species of gallery made in the form of a Y, each branch of which has an aperture, and both terminate in one where the animal lodges. As the whole is made on the declivity of a mountain, the innermost part alone is on a level. Both branches of the Y are inclined, and the one is used for depositing the excrements of the animals, and the other for their going out and coming in. The place of their abode is well lined with moss and hay, of which they make ample provision during the summer. It is even affirmed, that this labour is carried on jointly; that some cut the finest herbage, which is collected by others, and that they alternately serve as vehicles for transporting it to their dens. One, it is said, lies down on his back, allows himself to be loaded with hay, extends his limbs, and others trail him in this manner by the tail, taking care not to overset him. These repeated frictions are assigned as the reason why the hair is generally rubbed off their backs. But it is more probable, that this effect is produced by their frequent digging of the earth. But, whatever may be in this, it is certain that they dwell together, and work in common at their habitations, where they pass three-fourths of their lives. Thither they retire during rain or upon the approach of danger; and never go out but in fine weather, and even then to no great distance. One stands centinel upon a rock, while the others sport on the grass, or are employed in cutting it to make hay. When the centinel perceives a man, an eagle, a dog, &c. he alarms the rest with a loud whistle, and is himself the last to enter the hole. They make no provisions for winter; nor have they in that season any occasion for them, as lying asleep all that time. As soon as they perceive the first approaches of the sleeping season, they set to work in shutting up the two entrances of their habitation; and this they perform with such labour and solidity, that it is easier to dig the earth any where else than in the parts they have fortified. They are at this time very fat, weighing sometimes 20 pounds; and they continue to be plump for three months; but afterwards they gradually decay, and are extremely emaciated at the end of winter. When discovered in their retreats, they are found rolled up in the form of a ball, covered with hay; and they are carried off in so torpid a state, that they may be killed without seeming to feel pain. When taken young, they may be rendered nearly as tame as our other domestic animals. They are able to walk on their hind-feet, sit up often on their haunches, and carry food to their mouths with their fore-feet. They learn to seize a stick, to dance, to perform various gesticulations, and to obey the voice of their master. Like the cat, the marmot has an antipathy against dogs. When he begins to be familiar in the house, and perceives that

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that he is protected by his mafter, he attacks and bites dogs of the moft formidable kind. Though not fo large as a hare, he is ftouter, and his ftrength is aided by a peculiar fupplenefs and dexterity. With his fore-teeth, which are pretty long, he bites moft cruelly; he attacks not, however, either dogs or men unlefs previoufly irritated. If not prevented, he gnaws furniture and ftuffs; and when confined, pierces even through wood. His voice refembles the murmuring of a young dog when careffed or in a fporting humour; but when irritated or frighted, he makes a whiftling noife, fo loud and piercing, that it hurts the ear. The marmots eat every thing prefented to them; as flefh, bread, fruit, roots, pot-herbs, may-bugs, grafshoppers, &c. but milk and butter they prefer to every other aliment. Though lefs inclined to theft than the cat, they endeavour to flip into the dairy, where they drink great quantities of milk, making, like the cat, a murmuring noife expreffive of pleafure. Milk is alfo the only liquor that is agreeable to them; for they rarely drink water, and they refufe wine. They procreate but once a-year; and the female, after three or four weeks, produces two, three, or four young. The growth of their young is very quick; they live only nine or ten years; and the fpecies is neither numerous nor much diffufed. They are eafily caught when on plain ground, but with difficulty in their holes, as they dig deeper when in danger of being taken, except in winter when torpid; at which time they are caught in great numbers. They are fearched for partly on account of their flefh, which is tender and delicate; partly for their fkins; and partly for their fat, which is efteemed medicinal by the inhabitants of the Alps: but they are chiefly taken by the Savoyards for the purpofe of being expofed as fhows through various parts of Europe. The marmot would make very good eating, if it had not always a difagreeable flavour, which cannot be concealed but by ftrong feafonings.

Plate CCCXVII. fig. 6.

2. The monax, or American marmot, is about the fize of a rabbit. It has fhort rounded ears; the nofe and cheeks are bluifh; the body is of a deep brown colour; the tail is longifh, and very hairy. This fpecies inhabits the warmer ftates of North America and the Bahamas. It forms holes in the clefts of rocks and under the roots of trees, in which it paffes the winter in a torpid ftate; though it is uncertain if thofe of the Bahamas hybernate, as the climate of thefe iflands is very mild. It feeds on vegetables; and its flefh is very good, refembling that of a pig.

Plate CCCXIX. fig. 23.

3. The bobac, or Polifh marmot, is of a greyifh colour, mixed with long dufky hairs on the upper parts of the body, the under parts yellowifh: It has fmall oval ears, fmall eyes, a hairy ftraight tail, and the fore-feet have each a claw in place of the thumb or fifth toe. The head and body meafure fixteen inches, the tail four and a half. This fpecies inhabits the dry and funny places of the mountains, from the Borifthenes through the temperate climes of Afia as far as China and Kamtfchatka. It forms very deep burrows, in which focieties of 20 or more live together, each individual having a particular neft at the bottom of the common gallery, which is often three or four yards deep, and from which numerous galleries or paffages branch off to the feveral apartments. They go about in fearch of food in the morning and middle of the day, placing a centinel to give warning of approaching danger. The bobak is a timid animal, and feeds only on vegetables, chiefly oleraceous plants. It fits up on the hams, and carries its food with the fore paws to its mouth, and defends itfelf in the fame pofture. It may be eafily tamed even when old: it then eats cabbages or bread, and laps milk; but refufes to drink water. In fummer it feeds voracioufly; but remains torpid all winter, except when kept in very warm places: and even then it eats very little; and efcapes if poffible, that it may get to fome place proper for hybernating; but returns to its mafter in fpring. The flefh refembles that of a hare, though rank; the fat is ufed for dreffing leather and furs; and the fkins are employed for clothing by the Ruffians. The female has eight teats; and probably brings forth early, as by the month of June the young ones are half grown.

4. The citillus, or earlefs marmot, is of a variable colour, has a convex head, no external ears, and a fhort hairy tail. This fpecies inhabits the fouthern parts of Ruffia as far as Kamtfchatka, and the iflands between Afia and America; is found in Perfia and China; but is now rarely met with in the reft of Europe. They dwell in open, high, dry, and uncultivated places, preferring turfy and loamy foils, near the high roads, and never frequent bogs or woods. Each individual has its feparate burrow, in which, for provifion in the beginning and end of winter, it lays up magazines of grain, tender vegetables, and berries; fometimes, though rarely, the carcafes of mice and fmall birds are added. In the middle of winter thefe animals lie torpid during the greateft feverity of the froft. From the very beginning of fpring, as foon as the weather becomes mild, they go out in the day time in queft of food, which they eat fitting on their haunches, carrying it in their fore paws to the mouth. The male is very eafily tamed; but the female is fiercer, more given to bite, and is lefs eafily made tame; fhe goes between three and four weeks with young, and brings forth from three to eight young ones about the beginning of May. The fur is very good in the fpring, and the flefh is reckoned tolerable. They are preyed on by polecats, weafels, hawks, carrion crows, and cranes.

Plate CCCXVII. figs. 1. & 4.

This animal varies confiderably both in fize and colour, being fometimes as large as the common marmot, and fometimes not larger than the water-rat. In general the colour is of a yellowifh afh on the upper parts, and dirty white on the belly, (the *zizel* of Buffon); fometimes it is variegated either with waves or fmall fpots of white, (the fouflik of the fame author.) Some are white on the upper parts, and waved with tawny or yellow, being pale yellow on the lower parts of the body, and having a longifh tail, with fhed hair like that of a fquirrel: others are of a grey colour on the upper parts of the body, fpotted with white; the under parts being of a yellowifh white, with white orbits, and the face, between the eyes and the nofe, of a brownifh yellow, with a fhort tail.

5. The empetra, or Canadian marmot, is of a mixed grey colour on the upper parts of the body; the lower parts orange; having fhort rounded ears, and a hairy tail. It is rather larger than a rabbit, and the tail is about two inches and a half long; the head is round, with a blunt nofe, and fhort rounded ears; the cheeks Fig. 8.

are

Mus. are full, and of a grey colour; the face is dusky, with a black nose; the hair on the back is grey at the roots, black in the middle, and whitish at the tips; the belly and legs are of an orange colour; the feet are black and naked, having four long, slender, divided toes, and the rudiments of a thumb on each fore-foot, and five similar on each behind, all armed with pretty strong claws. This animal was described by Mr Pennant from a living specimen in possession of Mr Brooks, which was very tame, and made a hissing noise. It inhabits Canada, Hudson's Bay, and the other northern parts of America.

Five or six other species of arctomys, some of them suspected to be only varieties, are described by Kerr.

III. Dipus, or *Jerboa*. There are two fore-teeth in each jaw: the tail is long, and tufted at the end: but the most striking characteristic of this genus is the enormous length of the hind feet and extreme shortness of the fore-paws. From this conformation, instead of walking or running on all fours, they leap or hop on the hind feet like birds, making prodigious bounds, and only use the fore paws for burrowing, or for carrying their food to the mouth like squirrels. From this peculiarity of conformation, the kanguru, G. xix. sp. 15. and Philip's opossum, sp. 16. of the same genus (Mr Kerr observes), ought to have been arranged with this genus of the jerboa; but from a rigid adherence to artificial system, they are by Dr Gmelin ranked with the genus opossum, on account of the number and arrangement of their teeth. See the article Didelphis.

1. The jaculus, or common jarboa, has four toes on all the feet, and a claw in place of a thumb or fifth toe on each fore-foot. The body is somewhat more than seven inches long, and the hind legs and thighs are longer than the body. The upper parts are of a pale tawny colour, and the under parts white: the ears and feet are flesh coloured. The female has eight distantly placed teats. These animals inhabit Egypt, Arabia, Calmuck Tartary, and southern Siberia. They frequent firm hard ground, and fields covered with grass and herbs, where they form burrows of several yards long in a winding direction, leading to a large chamber about half a yard below the surface; and from this a second passage is dug to within a very little of the surface, by which they can escape when threatened with danger. When at rest, they sit with their hind legs bent under their belly, and keep the fore legs so near the throat as hardly to be perceptible. They eat grain and herbage like the hare. Their dispositions are mild, and yet they can never be perfectly tamed. Two that were kept in a house in London burrowed almost through the brick-wall of the room where they were; they came out of their hole at night for food; and when caught were much fatter and sleeker than when confined to their box.

This animal is eaten by the Arabs, who call it the *lamb of the children of Israel*. It has been particularly noticed and described by Mr Bruce in his Abyssinian Travels *. He says it inhabits the smoothest places of the desart, especially those where the soil is fixed gravel. In this it burrows, and has its hole divided into many apartments. It seems, however, to be afraid of the ground falling in upon it, as it chooses always to dig under the roots of some bushy plant or shrub. It particularly delights in those places which are frequented by the cerestes or horned viper, though it would appear that the serpent sometimes preyed upon it; for Mr Bruce tells us that he once saw a jerboa taken out of the belly of a female viper big with young, and almost consumed by the digestive powers of the animal. It is a very cleanly creature, and keeps its hair always in excellent order. It jumps about with great agility, in which it is assisted by its long tail, which we should suppose would rather be a hinderance to it. The Arabs of the kingdom of Tripoli in Africa teach their grehounds to hunt the Antelope, by learning them first to catch jerboas; and so agile are the latter, that Mr Bruce has often seen, in a large court-yard or inclosure, the grehound employed a quarter of an hour before he could kill his diminutive adversary; and had he not been well trained, so that he made use of his feet as well as his teeth, he might have killed two antelopes in the time he could have killed one jerboa. This animal is very fat, and the flesh well coloured; the buttocks, thighs, and part of the back, are roasted and eaten by the Arabs, as already mentioned, and taste almost exactly like a young rabbit, but without the strong smell of the latter. It is said, that the flesh dried in the air is very nourishing, and prevents costiveness; so that it seems to be endowed also with medicinal qualities. The animal is found in most parts of Arabia and Syria, and in all parts of the southern desarts of Africa; but nowhere in such plenty as in the Cyrenaicum or Pentapolis. In his journey thither, Mr Bruce employed several Arabs, together with his own servants, to kill these animals with sticks, that their skins might not be hurt with shot. Having got them dressed in Syria and Greece, and sewed together, making use of the tail, as in ermine, for the lining of a cloak, he found they had a very good effect, making a finer and glossier appearance the longer they were worn.

* Vol. V. p. 121.

Bochart thinks this animal is the *Saphon* of holy writ, and displays a vast deal of learning on the subject. But this opinion is refuted by Mr Bruce, who observes, that the saphon is gregarious, and builds in rocks; being likewise distinguished for its feebleness, which it supplies by its wisdom; and none of these characters apply to the jerboa: "therefore (says Mr Bruce) though he chews the cud in common with some others, and was in great plenty in Judea, so as to be known to Solomon, yet he cannot be the saphon of Scripture." He supposes with great probability, that it is the creature termed the *mouse*, Isa. lxvi. 17.; and says that in the Arabic version the word is expresly translated *jerboa*. See the article Saphon.

2. The sagitta, or Arabian jerboa, has three toes on the hind feet, and no thumb or fifth toe on the fore-paws. It is only about six inches long, and the tail rather shorter than the body; the soles of the hind-feet and bottom of the toes are covered with a very thick coat of hair; the head is more rounded than that of the preceding animal, and the ears are much longer than the head. It inhabits Arabia, and near the Irtish in Siberia, where it frequents the sandy plains.

The two following are distinguished as different species by Mr Pennant, though Dr Gmelin seems not to have considered them as distinct from the preceding.

Mus.

Plate CCCXVIII fig. 16. A. The ægyptius, or Egyptian Jerboa, has three toes only on the hind feet; and four toes, with a fcarcely apparent thumb or fifth toe, furnifhed with a claw, on the fore-paws.

This animal Mr Pennant fuppofes to be the *mus bipes* of the ancients, *mus fagitta* of Pallas, *jerbo* of Buffon, and *daman Ifrael* of the Arabs. He fays, that it inhabits Egypt, Barbary, Paleftine, the deferts between Bafora and Aleppo, the fandy tracks between the Don and Volga, and the hills fouth of the Irtifh.

Fig. 17. B. The fibiricus, or Siberian jerboa, with three toes on the hind feet, and two fpurious toes fome way up the legs; five toes on the fore feet, the thumb or fifth toe having no nail. Of this fpecies Mr Pennant diftinguifhes four varieties, the major, medius, minor, and pumilio; differing in fize, colour, &c. But they all (he fays) agree in manners. They burrow in hard ground, clay, or indurated mud; not only in high and dry fpots, but even in low and falt places. They dig their holes with great celerity, not only with their fore-paws but with their teeth, and flinging the earth back with their hind feet fo as to form a heap at the entrance. The burrows are many yards long, but not above half a yard deep. Thefe run obliquely; and end in a large fpace or neft, the receptacle of the fineft herbs. They have ufually but one entrance; yet by a wonderful fagacity they work from their neft another paffage to within a very fmall fpace of the furface, which in cafe of neceffity they can burft through, and fo efcape.

They fleep rolled up with their head between their thighs: At fun-fet they come out of their holes, clear them of the filth, and keep abroad till the fun has drawn up the dews from the earth. On approach of any danger, they immediately take to flight, with leaps of a fathom in height, and fo fwiftly that a man well mounted can hardly overtake them. They fpring fo nimbly, that it is impoffible to fee their feet touch the ground. They do not go ftraight forward, but turn here and there till they gain a burrow, whether it is their own or that of another. When furprifed, they will fometimes go on all fours, but foon recover their attitude of ftanding on their hind legs like a bird: even when undifturbed, they ufe the former attitude; then rife erect, liften, and hop about like a crow. In digging or eating they drop on their fore legs; but in the laft action will often fit up and eat like a fquirrel. They are eafily tamed; and feek always a warm corner. They foretel cold or bad weather by wrapping themfelves clofe up in hay; and thofe which are at liberty ftop up the mouths of their burrows. In a wild ftate they live much on oleraceous plants: the fmall ftature of the pumilio is attributed to its feeding on faline plants. Thofe of the middle fize, which live beyond the lake Baikal, feed on the bulbs of the *lilium pomponium*, and they gnaw the twigs of the *robinia caragana*. When confined, they will not refufe raw meat or the entrails of fowls. —They are the prey of all leffer rapacious beafts; and the Arabs, who are forbidden all other kinds of mice, efteem thefe the greateft delicacies. The Mongols have a notion that they fuck the fheep: certain it is they are during night very frequent among the flocks, which they difturb by their leaps. Thefe animals breed often in the fummer; in the fouthern parts in the beginning of May; beyond Baikal not till June. They bring perhaps eight at a time, as they have fo many teats. They fleep the whole winter without nutriment. About Aftracan, they will fometimes appear in a warm day in February; but return to their holes on the return of cold.

3. The cafer, or Cape jerboa, has four toes on the hind-feet and five on the paws; the tail is very hairy, and tipt with black.—This fpecies, which inhabits the Cape of Good Hope, is larger than any of the foregoing, being 14 inches long, the tail 15, the ears three. It is called *aerdmannetie*, or little earth man, and *fpringen haas*, or leaping hare, by the Dutch at the Cape. It has a grunting voice; is very ftrong, and leaps 20 or 30 feet at one bound. It burrows with its fore feet; and fleeps fitting on its hind legs, with the knees feparated, the head between, and holding its ears with the fore-paws over its eyes. It is eaten by the natives; and is caught by pouring water into its hole, which forces it to come out.

4. The meridianus, Cafpian jerboa, or long-legged moufe, has five toes behind and three before, with the rudiments of a thumb or inner toe. It is five inches long, and the tail three.—This fpecies inhabits the fandy deferts between the Ural and Volga, near the Cafpian.—It forms burrows, with three entrances, about a yard in depth; and feeds chiefly on the feeds of the pterococci and aftragali. Plate CCCXIX. fig. 6.

5. The lamaricinus, or marfh jerboa, has five toes behind and three before, with the rudiments of a fourth; the tail is obfcurely annulated. The body and head meafure about five inches and a half in length; the tail is about the fame length.—This fpecies inhabits the falt marfhes near the Cafpian fea; and is fuppofed to feed on the fruit of the tamarix and nitrarium, which grow in thefe marfhes. Under the roots of thefe trees it forms very deep burrows, which have two entrances. It is a very elegant little animal. There are two or three other fpecies of this genus. Fig. 19.

IV. The Cavia, or *Cavy*; a genus which feems to hold a midle place between the murine and the leporine quadrupeds. The characters are: there are two wedge-like cutting teeth in each jaw, and eight grinders in both jaws: the fore-feet are furnifhed with four or five toes: the hind-feet with three, four, or five each: the tail is either very fhort or entirely wanting: there are no clavicles or collar-bones.

1. The paca, or fpotted cavy, has five toes on all the feet; and the fides are marked with rows of grey or pale yellow fpots. The body and head meafure about two feet in length; the tail is like a fmall button, and fo extremely fhort as to be hardly apparent; the mouth is very fmall, and the upper lip is divided; the noftrils are very large, and the muzzle is garnifhed with long whifkers; the ears are fhort and roundifh; the eyes are large, prominent, and brownifh; the two cutting teeth in each jaw are very long and of great ftrength; the hind legs are longer than the fore.—This fpecies inhabits Brafil, Guiana, and probably all the warmer parts of America. It lives in fenny places near rivers, burrowing in the ground, and keeping its hole exceedingly clean, to which it has always three diftinct outlets: It grows very fat, and is efteemed a great delicacy. The female has two Plate CCCXVII. fig. 13.

Mus. two teats ſituated between the hind-thighs, and has only a ſingle young one at a litter.—It is difficult to take this animal alive. When ſurpriſed in its hole, which the hunters lay open both before and behind, it defends itſelf, and even bites fiercely.—It is, however, eaſily accuſtomed to a domeſtic life. Unleſs induſtriouſly irritated, it is gentle and tractable, fond of adulation, and licks the hands of the perſon who careſſes it. It knows thoſe who take care of it, and readily diſtinguiſhes their voices. When gently ſtroaked on the back, it ſtretches itſelf out, lies down on its belly, by a ſmall cry expreſſes its acknowledgement, and ſeems to aſk a continuance of the favour: but if ſeized in a rough manner, it makes very violent efforts to eſcape. When kept in a wooden cage or box, this animal remains perfectly tranquil during the day, eſpecially when plentifully ſupplied with food. It ſeems even to have an affection for its retreat as long as the day laſts; for, after feeding, it retires ſpontaneouſly into it. But when night approaches, by perpetual reſtleſſneſs and agitation, and by tearing the bars of its priſon with its teeth, it diſcovers a violent deſire of getting out. Nothing of this kind happens during the day, unleſs it has occaſion for ſome natural evacuation; for it cannot endure the ſmalleſt degree of dirtineſs in its little apartment; and when about to void its excrements, always retires to the moſt diſtant corner it can find. When its ſtraw begins to ſmell, it often throws it out, as if it meant to demand freſh litter. This old ſtraw it puſhes out with its muzzle, and goes in queſt of rags or paper to replace it. In a female cavy, the following extraordinary inſtance of cleanlineſs was obſerved. A large male rabbit being ſhut up with her when ſhe was in ſeaſon, ſhe took an averſion to him the moment he voided his excrement in their common apartment. Before this ſhe was very fond of him; licked his noſe, ears, and body; and allowed him to take almoſt the whole food that was given her. But as ſoon as the rabbit had infected the cage with his ordure, ſhe retired into the bottom of an old preſs, where ſhe made a bed with paper and rags, and returned not to her old lodging till ſhe ſaw it neat, and freed from the unclean gueſt which had been preſented to her.

2. The agouti, which is about the ſize of a rabbit, has a very ſhort tail; four toes on the fore feet, and three on the hind ones; the upper parts of the body of a browniſh colour mixed with red and black, the rump orange, and the belly yellowiſh. Of this
Plate CCCXVII. fig. 10. 11. ſpecies there are three varieties mentioned by authors, viz. the leſſer cunicularis or long-noſed cavy, which is about the ſize of a rabbit; the leporina or larger rabbit, called the *java hare*, or *javan cavy*, which is as large as a hare; and the americana, which ſeems to be but little known. They all inhabit South America and the Weſt India iſlands; dwelling in hollow trees, or burrowing in the ground. They ſearch for their food, which is entirely vegetable, during the day, and carry it home with them to their dwellings: when feeding they ſit on their hind legs, and carry their food with the fore-paws to the mouth. They grow very fat, and are very good eating, their fleſh being white and ſavoury like that of a rabbit. They breed frequently in the ſame year, the female bringing three, four, or five young ones at a birth. They grunt like pigs, are very voracious, and when fat, their fleſh is white like that of a rabbit, but dry. What food they cannot immediately conſume they hoard in their retreats, and eat at their leiſure. Their pace is hopping like that of a hare or rabbit; they beat the ground like them with their feet, when angry; they ſtop and liſten to the ſound of muſic; and they take ſhelter, when purſued, in their holes, or in hollow trees.—They are hunted with dogs. When one of them is forced among the cut ſugar canes, he is ſoon taken; becauſe theſe grounds being generally covered a foot thick with ſtraw and leaves, at each leap he ſinks in this litter, ſo that a man may overtake and ſlay him with a baton. He commonly runs very nimbly before the dogs; and when he gains his retreat, he lies ſquat, and remains obſtinately in his concealment. The hunters are obliged to chace him out by filling his hole with ſmoke. The animal, half ſuffocated, utters mournful cries; but never iſſues forth unleſs when puſhed to the laſt extremity. His cry, which he often repeats when diſturbed or irritated, reſembles that of a ſmall hog. If taken young, he is eaſily tamed, and goes out and returns of his own accord.

3. The cobaya, or reſtleſs cavy, has four toes on the Fig. 5. fore and three on the hind-feet, with no tail: it is about ſeven inches in length; and the whole body is white, uſually variegated with irregular orange and black blotches. This ſpecies inhabits Braſil; but its manners in a wild ſtate are not mentioned by authors. In a domeſtic ſtate, as they appear in Europe, they are very reſtleſs, and make a continual noiſe.—They feed on all kinds of herbs; but eſpecially on parſley, which they prefer to grain or bread; and they are likewiſe fond of apples and other fruits. They eat precipitately like the rabbit, little at a time, but very often. Buffon ſays they never drink; but Gmelin, that they drink water. Their voice is commonly a kind of grunt like a young pig; when engaged in their amours, it reſembles the chirp of a bird; and when hurt, they emit a ſharp cry. They are of a tame and gentle, but ſtupid diſpoſition. The female breeds at two months old, bringing from four or five to ten or twelve young ones at a birth, though ſhe has only two teats; and breeds very often during the year, as ſhe goes but three weeks with young, and takes the male 12 or 15 days after littering. As they breed ſo faſt, their multitudes would be innumerable, if there were not ſo many enemies which deſtroy them. They cannot reſiſt either cold or moiſture: when cold, they aſſemble and crowd cloſe together; in which caſe they often all periſh together. They are alſo devoured in great numbers by cats, and many are killed by the males. Rats are ſaid to avoid their haunts. They are called in England *Guinea-pigs*, from their being ſuppoſed to come from that country.

4. The magellanica, or Patagonian cavy, has hardly Fig. 12. any tail; the ſides of the noſe are garniſhed with tufts of curly hair and long numerous whiſkers. This ſpecies inhabits the country about Port Deſire in Patagonia, and is of conſiderable ſize, ſometimes weighing 26 pounds. It has the ſame manners with the reſt of the genus; it ſits on its hind legs, burrows in the ground, and feeds on vegetables. The fleſh is very white, and has an excellent flavour.

Plate CCCXIX. fig. 22. 5. The capybara, or thick-nofed tapir, has no tail; the hind feet have each three webbed toes. The length of the animal, when full grown, is above two feet and a half: the head and nofe are very large and thick; having fmall, erect, rounded, naked ears, and large black eyes: and the nofe is garnifhed with numerous black whifkers; in each jaw are two large ftrong fore-teeth, and eight grinders; the legs are fhort, having the toes connected by a web, and their extremities are guarded with a kind of hoofs inftead of claws; the neck is fhort and thick; the hair is fhort, rough, and harfh, like briftles, being longeft on the back, and moft of them are yellowifh in the middle and black at both ends.—This fpecies inhabits the eaftern fide of South America, from the ifthmus of Darien to Brafil and Paraguay; living in fenny woods near the large rivers, fuch as the Amazons, Oroonoko, and Plata. They fwim and dive remarkably well, and keep for a long time under water. They catch fifh at night with great dexterity, and bring them on fhore to eat them; which they do fitting on the hind legs, and holding the food in the fore-paws like the apes. They likewife live on fruits and vegetables, efpecially the fugar cane, and feed only in the night. They keep together in large herds, making a great noife like the braying of affes, and do vaft mifchief in gardens. They grow very fat; and the flefh is eaten, being tender, but has an oily and fifhy flavour. In the breeding feafon, one male and one female live together, and the female only produces a fingle one at a birth. Thefe animals are eafily rendered tame, and become very familiar.

Plate CCCXVII. fig. 3. 6. The acufchy, or olive cavy, has a fhort tail; the upper parts of the body are of an olive colour, the under parts whitifh. This fpecies inhabits Guiana, Cayenne, and Brafil.—It is about the fize of an half-grown rabbit, is eafily tamed, and is reckoned very delicate food. The female brings one, fometimes two, at a litter. This animal refembles the agouti, but is uniformly fmaller, has a tail of fome length, and is of a different colour. It inhabits the woods, living on fruits; abhors water; and fometimes, though rarely, makes a cry like that of the reftlefs cavy.

There are five or fix other fpecies defcribed by authors as belonging to the cavy genus. Two of them, however, have been lately marked by Dr Gmelin under a new genus, *Hyrax;* which, as there was not an opportunity of introducing it in the order of the alphabet, we fhall here fubjoin, together with the defcriptions of the fpecies as given by Mr Kerr.

V. Hyrax, or *afhkoko.* There are two broad and diftant fore-teeth above; four contiguous, broad, flat, notched fore-teeth below; and four large grinders on each fide in both jaws. The fore feet have four toes, the hind feet only three. There is no tail; and the clavicles are wanting.

Fig. 9. 1. The capenfis, or cape afhkoko, "has flat nails on all the toes, except one toe of each hind-foot which is armed with a fharp pointed claw. It inhabits the Cape of Good Hope.—This animal is about the fize of a rabbit, being about 15 inches long; the head is fhort, with the back part very thick, and the fnout very fhort and blunt; the eyes are fmall; the ears are oval and open, brown, woolly, and half hid in the fur; the legs are very fhort, the upper joints of both being concealed beneath the fkin; the hind legs are rather longer than the fore; the feet are large, black, and naked: the body is fhort, thick, and contracted, with a prominent belly, and is covered with a foft woolly fur of a yellowifh brown or greyifh colour, hoary at the roots; the fides are of a dirty whitifh grey; and along the back is a brownifh ftripe: this fur is interperfed with longer and coarfer black hairs, and a few very coarfe long briftles. The fore-feet have four fhort, fcarce divided, thick toes, furnifhed with flat nails; the two outer toes of the hind-feet are fimilar, but the inner toe is longer, and has a fharp claw. This animal has a fharp voice, and acute fenfe of hearing; its gait is very wavering and unfteady, owing to the fhortnefs of its thighs and unequal length of the hind and fore legs; notwithftanding of which it is very active, and moves by leaps: it is very cleanly, lives entirely on vegetable food, drinks little, is fond of heat, and burrows in the ground. In manners and general appearance, this animal refembles the marmot and cavy; in the conformation of its toes it has fome analogy with the maucauco; but from the circumftances of the teeth it cannot be ranked with the laft; and the peculiarity of the feet has caufed Dr Gmelin to feparate it from both of the former."

Plate CCCXIX. fig. 21. 2. The fyriacus, or Syrian afhkoko, (Bruce, Schreber), "has foft tender nails on all the toes. It inhabits Syria and Ethiopia.—The body of this is more lengthened than that of the former, and the fnout more oblong. The fur is of a reddifh grey colour like that of the wild rabbit, the throat, breaft, and belly, being white; all over the body a number of long, ftrong, and polifhed hairs are fcattered among the fur. The body and head of the individual defcribed by Mr Bruce meafured 17 inches. The ears are broad, open, and rounded; each fide of the mouth is garnifhed with long whifkers. In walking, which is performed creeping low with the belly almoft touching the ground, the hind feet are ufed as far as the heel. All the toes have fhort, broad, weak, flat nails, except the inner toe of the hind foot, which is provided with a flat crooked nail fomewhat longer than the reft; the foles of the feet are formed of flefhy naked protuberances, divided by furrows. It lives moftly about the mouths of caves or clefts in rocks; is gregarious; feeds entirely on vegetables; is mild, feeble, timid, and eafily tamed, and has no voice or cry. Mr Bruce is of opinion, that this animal is the gannim or Daman Ifrael of the Arabs, and the faphan of facred fcriptures, which has erroneoufly been tranflated *the rabbit.*—Its flefh is very white, but is not eaten by the Abyffinians or Mahometans. The fame celebrated traveller is of opinion, that it ruminates or chews the cud."

MUSA, the plantain-tree: A genus of the monœcia order, belonging to the polyandria clafs of plants; and in the natural method ranking under the eighth order, *Scitamineæ.* The calyx of the male hermaphrodite is a fpatha or fheath; the corolla is dipetalous; the one petal erect and quinquedentate; the other nectariferous, concave, and fhorter; there are fix filaments; five of which are perfect; one ftyle; the germen inferior and abortive. The female hermaphrodite has the calyx, corolla, filaments, and piftil of the male hermaphrodite, with only one filament perfect; the berry is oblong, and three-angled below. The

 moft

Musa.

most remarkable species are, 1. The *paradisaica*, or plantain; 2. The *musa sapientum*, or banana-tree. See Plate CCCXX.

The first sort is cultivated in all the islands of the West Indies, where the fruit serves the Indians for bread; and some of the white people also prefer it to most other things, especially to the yams and cassada bread. The plant rises with a soft stalk 15 or 20 feet high; the lower part of the stalk is often as large as a man's thigh, diminishing gradually to the top, where the leaves come out on every side;—these are often eight feet long, and from two to three feet broad, with a strong fleshy midrib, and a great number of transverse veins running from the midrib to the borders. The leaves are thin and tender, so that where they are exposed to the open air, they are generally torn by the wind; for as they are large, the wind has great power against them: these leaves come out from the centre of the stalk, and are rolled up at their first appearance; but when they are advanced above the stalk, they expand and turn backward. As these leaves come up rolled in the manner before-mentioned, their advance upward is so quick that their growth may almost be discerned by the naked eye; and if a fine line is drawn across level with the top of the leaf, in an hour's time the leaf will be near an inch above it. When the plant is grown to its full height, the spikes of flowers will appear in the centre, which is often near four feet in length, and nods on one side. The flowers come out in bunches; those in the lower part of the spike being the largest; the others diminish in their size upward. Each of these bunches is covered with a spath or sheath of a fine purple colour, which drops off when the flowers open. The upper part of the spike is made up of male or barren flowers, which are not succeeded by fruit, but fall off with their covers. The fruit or plantains are about a foot long, and an inch and a half or two inches diameter: it is at first green, but when ripe of a pale-yellow colour. The skin is tough; and within is a soft pulp of a luscious sweet flavour. The pikes of fruit are often so large as to weigh upwards of 40 lb. The fruit of this sort is generally cut before it is ripe. The green skin is pulled off, and the heart is roasted in a clear fire for a few minutes, and frequently turned: it is then scraped, and served up as bread. Boiled plantains are not so palatable. This tree is cultivated on a very extensive scale in Jamaica; without the fruit of which, Dr Wright says, the island would scarce be habitable, as no species of provision could supply their place. Even flour or bread itself would be less agreeable, and less able to support the laborious negro, so as to enable him to do his business or to keep in health. Plantains also fatten horses, cattle, swine, dogs, fowls, and other domestic animals.

The leaves being smooth and soft are employed as dressings after blisters. The water from the soft trunk is astringent, and employed by some to check diarrhœas. Every other part of the tree is useful in different parts of rural economy. The leaves are used for napkins and table-cloths, and are food for hogs.

The second sort differs from the first, in having its stalks marked with dark purple stripes and spots.—The fruit is shorter, straighter, and rounder: the pulp is softer, and of a more luscious taste. It is never eaten green; but when ripe, it is very agreeable, either eaten raw or fried in slices as fritters; and is relished by all ranks of people in the West Indies.

Musa.

Both the above plants were carried to the West Indies from the Canary Islands; whither, it is believed, they had been brought from Guinea, where they grow naturally. They are also cultivated in Egypt, and in most other hot countries, where they grow to perfection in about 10 months from their first planting to the ripening of their fruit. When their stalks are cut down, there will several suckers come up from the root, which in six or eight months will produce fruit; so that by cutting down the stalks at different times, there is a constant succession of fruit all the year.

In Europe there are some of these plants preserved in the gardens of curious persons, who have hot-houses capacious enough for their reception, in many of whom they have ripened their fruit very well; but as they grow very tall, and their leaves are large, they require more room in the stove than most people care to allow them. They are propagated by suckers, which come from the roots of those plants which have fruited; and many times the younger plants, when they are stinted in growth, will also put out suckers.

The fruit of the banana-tree is four or five inches long, of the size and shape of a middling cucumber, and of a high, grateful flavour: the leaves are two yards long, and a foot broad in the middle; they join to the top of the body of the tree, and frequently contain in their cavities a great quantity of water, which runs out, upon a small incision being made into the tree, at the junction of the leaves. Bananas grow in great bunches, that weigh a dozen pounds and upwards. The body of the tree is so porous as not to merit the name of wood; the tree is only perennial by its roots, and dies down to the ground every autumn.

When the natives of the West Indies (says Labat) undertake a voyage, they make provision of a paste of banana; which, in case of need, serves them for nourishment and drink: for this purpose they take ripe bananas; and having squeezed them through a fine sieve, form the solid fruit into small loaves, which are dried in the sun or in hot ashes, after being previously wrapped up in the leaves of Indian flowering-reed.—When they would make use of this paste they dissolve it in water, which is very easily done; and the liquor, thereby rendered thick, has an agreeable acid taste imparted to it, which makes it both refreshing and nourishing.—The banana is greatly esteemed, and even venerated, by the natives of Madeira, who term it the *forbidden fruit*, and reckon it a crime almost inexpiable to cut it with a knife; because, after dissection, it exhibits, as they pretend, a similitude of our Saviour's crucifixion; and to cut the fruit open with a knife, is, in their apprehension, to wound his sacred image.

Some authors have imagined, that the banana-tree was that of the leaves of which our first parents made themselves aprons in Paradise. The sacred text, indeed, calls the leaves employed for that purpose *fig-leaves;* and Milton, in a most beautiful but erroneous description, affirms the bearded or Bengal fig to have been the tree alluded to. But besides that the fruit of the banana is often by the most ancient authors called

Mufa.

called a *fig*, its leaves, by reafon of their great fize and folidity, were much more proper for a veil or covering than thofe of the Bengal fig, which are feldom above fix or eight inches long and three broad. On the other hand, the banana leaves being three, four, and five feet long, and proportionably broad, could not fail to be pitched upon in preference to all others; efpecially as they might be eafily joined, or fewed together, with the numerous thread-like filaments that may, with the utmoft facility, be peeled from the body of this tree.

Some have fuppofed the Abyffinian plant *enfete* to be a fpecies of mufa. It is faid to be a native of the province of Narea, where it grows in the great marfhes and fwamps for which that province is remarkable, owing to the many rivers which originate in that country, and have but a fmall declivity to the ocean. This plant, as well as the coffee-tree, is faid to have been unknown in Abyffinia before the arrival of the Galla, who imported them both along with them. It comes to great perfection about Gondar; but the principal plantations of it are in that part of Maitfha and Gouth, to the weft of the Nile, where it is almoft the fole food of the Galla who inhabit that country. Maitfha is almoft entirely on a dead level; fo that the rains ftagnate and prevent the fowing of grain. Were it not for the enfete, therefore, the Galla would have fcarce any vegetable food. Mr Bruce * thinks that the enfete may have been cultivated in fome of the gardens of Egypt about Rofetto, but that it was not a native of the country. He ftrongly controverts the opinion that this plant is a fpecies of mufa. "It is true (fays he), the leaf of the banana refembles that of the enfete: it bears figs, and has an excrefcence from its trunk, which is terminated by a conical figure, chiefly differing from the enfete in fize and quantity of parts; but the figs of the banana are of the fize and figure of a cucumber, and this is the part which is eaten. This fig is fweet, though mealy, and of a tafte highly agreeable. It is fuppofed to have no feeds, though in fact there are four fmall black feeds belonging to every fig. But the figs of the enfete are not eatable: they are of a foft tender fubftance; watery, taftelefs, and in colour and confiftence refembling a rotten apricot: they are of a conical form, crooked a little at the lower end; about an inch and an half in length, and an inch in breadth where thickeft. In the infide of thefe is a large ftone half an inch long, of the fhape of a bean or cafhew-nut, of a dark-brown colour; and this contains a fmall feed, which is feldom hardened into fruit, but confifts only of fkin. The long ftalk that bears the figs of the enfete fprings from the centre of the plant, or rather is the body or folid part of the plant itfelf. Upon this, where it begins to bend, are a parcel of loofe leaves; then grows the fig upon the body of the plant without any ftalk; after which the top of the ftalk is thickfet with fmall leaves, in the midft of which it terminates the flower in the form of an artichoke; whereas in the banana, the flower in form of the artichoke grows at the end of that fhoot or ftalk, which proceeds from the middle of the plant, the upper part of which bears the row of figs. The leaves of the enfete are of a web of longitudinal fibres clofely fet together; the leaves grow from the bottom without ftalks: whereas the banana is in form like a tree, and has been miftaken for fuch. One half of it is divided into a ftem, the other is a head formed with leaves; and in place of the ftem that grows out of the enfete, a number of leaves, rolled round together like a truncheon, fhoots out of the heart of the banana, and renews the upper as the under leaves fall off: but all the leaves of the banana have a long ftalk; this fixes them to the trunk, which they do not embrace by a broad bafe or involucrum as the enfete does.

* Travels, vol. v. p. 36.

"But the greateft differences are ftill remaining.—The banana has by fome been miftaken for a tree of the palmaceous kind, for no other reafon but a kind of fimilarity in producing the fruit on an excrefcence or ftalk growing from the heart of the ftem: but ftill the mufa is neither woody nor perennial; it bears the fruit but once; and in all thefe refpects it differs from trees of the palmaceous kind, and indeed from all fort of trees whatever. The enfete, on the contrary, has no naked ftem; no part of it is woody: the body of it, for feveral feet high, is efculent; but no part of the banana plant can be eaten. As foon as the ftalk of the enfete appears perfect and full of leaves, the body of the plant turns hard and fibrous, and is no longer fit to be eaten: before, it is the beft of all vegetables. When boiled, it has the tafte of the beft new wheat-bread not perfectly baked. When you make ufe of the enfete for eating, you cut it immediately above the fmall detached roots, and perhaps a foot or two higher, as the plant is of age. The green muft be ftripped from the upper part till it becomes white; when foft, like a turnip well boiled, if eat with milk or butter, it is the beft of all food, wholefome, nourifhing, and eafily digefted."

Our author now proceeds to confider an hieroglyphic fometimes met with in Egypt, viz. "the figure of Ifis fitting between fome branches of the banana-tree, as is fuppofed, and fome handfuls of ears of wheat. You fee likewife the hippopotamus ravaging a quantity of the banana tree. Yet the banana is merely adventitious in Egypt: it is a native of Syria: it does not even exift in the low hot country of Arabia Felix; but choofes fome elevation in the mountains where the air is temperate; and is not found in Syria farther to the fouthward than Lat. 34°.

For thefe reafons Mr Bruce thinks, that the banana not being a plant of the country, "could never have entered into the lift of their hieroglyphics; for this reafon it could not figure any thing regular or permanent in the hiftory of Egypt or its climate. I therefore imagine (adds he), that this hieroglyphic was wholly Ethiopian; and that the fuppofed banana, which, as an adventitious plant, fignified nothing in Egypt, was only a reprefentation of the enfete; and that the record in the hieroglyphic of Ifis and the enfete-tree was fomething that happened between harveft, which was about Auguft, and the time that the enfete-tree came in ufe, which was in October.—The hippopotamus is generally thought to reprefent a Nile that has been fo abundant as to be deftructive. When, therefore, we fee upon the obelifks the hippopotamus deftroying the banana, we may fuppofe it meant, that the extraordinary inundation had gone fo far as not only to deftroy the wheat, but alfo to retard or hurt the growth of the enfete, which was to fupply its place."

MUSÆUS,

MUSÆUS, an ancient Greek poet, was, according to Plato and Diodorus Siculus, an Athenian, the ſon of Orpheus, and chief of the Eleuſinian myſteries inſtituted at Athens in honour of Ceres: or, according to others, he was only the diſciple of Orpheus: but from the great reſemblance which there was between his character and talents and thoſe of his maſter, by giving a ſtronger outline to the figure he was called his *ſon*, as thoſe were ſtyled the *children of Apollo* who cultivated the arts of which he was the tutelar god.

Muſæus is allowed to have been one of the firſt poets who verſified the oracles. He is placed in the Arundelian marbles, epoch 15. 1426 B. C. at which time his hymns are there ſaid to have been received in the celebration of the Eleuſinian myſteries. Laertius tells us, that Muſæus not only compoſed a theogony, but formed a ſphere for the uſe of his companions; yet as this honour is generally given to Chiron, it is more natural to ſuppoſe, with Sir Iſaac Newton, that he enlarged it with the addition of ſeveral conſtellations after the conqueſt of the golden fleece. The ſphere itſelf ſhows that it was delineated after the Argonautic expedition, which is deſcribed in the aſteriſms, together with ſeveral other more ancient hiſtories of the Greeks, and without any thing later; for the ſhip Argo was the firſt long veſſel which they had built: hitherto they had uſed round ſhips of burthen, and kept within ſight of the ſhore; but now, by the dictates of the oracle, and conſent of the princes of Greece, the flower of that country ſail rapidly through the deep, and guide their ſhip by the ſtars.

Burney's Hiſtory of Muſic.

Muſæus is celebrated by Virgil in the character of hierophant, or prieſt of Ceres, at the head of the moſt illuſtrious mortals who have merited a place in Elyſium. Here he is made the conductor of Æneas to the receſs where he meets the ſhade of his father Anchiſes.

A hill near the citadel of Athens was called *Muſæum*, according to Pauſanias, from Muſæus, who uſed to retire thither to meditate and compoſe his religious hymns; at which place he was afterwards buried. The works which went under his name, like thoſe of Orpheus, were by many attributed to Onomacritus. Nothing remains of this poet now, nor were any of his writings extant in the time of Pauſanias, except a hymn to Ceres, which he made for the Lycomides. And as theſe hymns were likewiſe ſet to muſic, and ſung in the myſteries by Muſæus himſelf in the character of prieſt, he thence perhaps acquired from future times the title of *muſician* as well as of *poet*; the performance of ſacred muſic being probably at firſt confined to the prieſthood in theſe celebrations, as it had been before in Egypt, whence they originated. However, he is not enumerated among ancient muſicians by Plutarch; nor does it appear that he merited the title of *ſon* and *ſucceſſor to Orpheus* for his muſical abilities, ſo much as for his poetry, piety, and profound knowledge in religious myſteries.

MUSCA, the Fly, in zoology; a genus of inſects belonging to the order of diptera. The mouth is furniſhed with a fleſhy proboſcis, and two lateral lips; but it has no palpi. This genus is divided into two different ſections: 1. Thoſe with ſimple antennæ. 2. Thoſe which are furniſhed with a lateral hair or feather. Thoſe have downy bodies, though ſcarce perceptibly ſo; and have either a lateral plume or feather on the antennæ, or a ſimple hair on the ſide of the antennæ. The piloſæ have a few hairs ſcattered upon their bodies, principally upon the thorax; they have either a lateral feather or a lateral hair. Under theſe diviſions are comprehended about 400 different ſpecies, as enumerated in Dr Gmelin's edition of the *Syſtema Naturæ*. "Variety (as Mr Barbut obſerves) runs through their forms, their ſtructure, their organization, their metamorphoſes, their manner of living, propagating their ſpecies, and providing for their poſterity. Every ſpecies is furniſhed with implements adapted to its exigencies. What exquiſiteneſs! what proportion in the ſeveral parts that compoſe the body of a fly! What preciſion, what mechaniſm in the ſprings and motion! Some are oviparous, others viviparous; which latter have but two young ones at a time, whereas the propagation of the former is by hundreds. Flies are laſcivious troubleſome inſects, that put up with every kind of food. When ſtorms impend, they have moſt activity, and ſting with greateſt force. They multiply moſt in hot moiſt climates; and ſo great was formerly their numbers in Spain, that there were fly-hunters commiſſioned to give them chace. The vapour of ſulphur or arſenic deſtroys them; and their numbers may be reduced by taking them in phials of honeyed water, or between boards done over with honey." There are 129 ſpecies, principally diſtinguiſhed by the peculiarities in their feelers.

Musca, a name given to ſuch perſons among the Romans as officiouſly thruſt themſelves into the company of their ſuperiors and thoſe who deſpiſed them, by finding means of getting admittance to entertainments without invitation, and without a welcome: So that *muſcæ* were the ſame as paraſites, who were frequently by the Greeks termed Μυιαι. See Parasite.

MUSCADINE, a rich wine, of the growth of Provence, Languedoc, Cividad, &c.—The word, as well as the liquor, is French: Some fetch its original from *muſk*; the wine being ſuppoſed to have a little of the ſmell of that perfume; others from *muſca*, a "fly," becauſe the flies are extremely fond of its grapes; as the Latins had their *vinum apianum*, ſo called *ab apibus*, from the bees which fed on it.

The way of making muſcadine at Frontignac is as follows: They let the muſcadine grapes grow half dry on the vine; as ſoon as they are gathered, they tread and preſs them immediately, and tun up the liquor, without letting it ſtand and work in the fat; the lee occaſioning its goodneſs.

MUSCHENBROECK (Peter de), a very diſtinguiſhed natural philoſopher and mathematician, was born at Utrecht a little before 1700. He was firſt profeſſor of theſe in his own univerſity, and afterwards invited to the chair at Leyden, where he died full of reputation and honours in 1761. He was a member of ſeveral academies; particularly the Academy of Sciences at Paris. He was the author of ſeveral works in Latin, all of which ſhow the greateſt penetration and exactneſs in this way. He was alſo very conſummate in the knowledge of law.

MUSCI, Mosses, one of the ſeven families or claſſes into which all vegetables are divided by Linnæus in the *Philoſophia Botanica*. The ancients took the moſs of trees to be the effect of a diſorder or diſcompoſure of the texture of the bark; or at moſt a kind of little filaments ariſing from the bark: but the moderns find, by ſeveral obſervations, that moſſes are

Musci. all real distinct plants, whose seed, being extremely small, is inclosed in little capsulæ; which bursting of themselves, the seed is carried off by the winds; till, falling into the inequalities of the bark of trees, it is there stopped, takes root, and feeds at the expence of the tree, as mouldiness does on bread, &c.

What the botanical writers strictly understand by the word *moss*, is a class of plants appearing of an inferior rank to the common vegetables; the less perfect genera of which have been supposed to be wholly destitute of flower or seed, or any thing analogous to either, and to consist of simple, similar, and uniform parts; the genera a little above these have some diversity of parts, and carry something that looks analogous to vegetation in the common way, having a resemblance of those parts which serve other plants for their fructification. The more perfect genera of the mosses not only consist of different parts, but have also their appropriated organs containing a pulpy matter, which finally becomes dry, and assumes the form of a fine and subtile powder, composed of granules, each of which is either a seed or a granule of farina, serving for the propagation of the species.

The more imperfect mosses are distinguished from the others by their appearance to the naked eye; they are either in form of a fine lanugo or down covering the surface of different bodies; or else they appear as slender filaments, or foliaceous bodies, floating about in the water; or as filaments of a tougher texture, hanging down from the branches of old trees; or as little shrubs, or single horns, growing erect on the parched earth of mountains and heathy places; or finally, as broad and foliaceous bodies spreading themselves over the dry barks of trees or rocks, without any pedicle or other support.

The more perfect kinds of mosses are found in the shape of small but regular plants, divided into several branches, and clothed with leaves: these are of various forms and structures; some being broad and thin, others slender as hairs; some pellucid, others opake; some smooth, others hairy. From the alæ of these leaves in some kinds, and from the summit of the stalks in others, there arise heads or capsules of various figure and structure, but all unicapsular; some of these are naked, and others covered with a calyptra or hood; some stand on long pedicles, and others are placed close to the stalks. These heads are usually called *capsulæ*, which contain their seeds or farina, and their pedicles *setæ*, in the *mnia*, *hypna*, *brya*, and *polytricha*, &c.

These capsules in some are covered with a calyptra or hood; in others they are naked. Of the first kind are the *splachnum*, *polytricum*, *mnium*, *bryum*, *hypnum*, *fontinalis*, and *buxbaumia*; and of the latter sort, the *lycopodium*, *porella*, *sphagnum*, and *phascum*.

The substance with which the heads or capsules of all the mosses are filled, resembles either seeds, or the small globules of the farina of flowers, which all resemble seeds of particular figures in miniature. The fructifications of these minute plants seem to be either from these, as seeds falling to the earth; or, according to the opinion of some, they seem to contain only farina in the capsules, which impregnating certain bulbs or nodules in the alæ of the leaves, cause them to grow and vegetate, as is seen in some of the larger plants; as in the bulbs produced in the alæ of the leaves of the dentaria, and of the lilies, and some others. The former opinion, of the powder in the heads or capsules being actually perfect seeds, is the more probable, as the bulbs in the alæ of the leaves are found only in some of the hypna, and others of a few other genera; whereas the propagation is as quick and certain in those which have none of them as in those which have; and the want of female parts of fructification, which makes so many desiderata in the Linnæan system of botany, is easily made up, and the whole explained according to the usual course of nature in other vegetables, by allowing the powder in the capsules to be real seeds, and the small globules on the pointals surrounding the aperture of the capsule, the farina. Musci.

The opinion of the mosses growing from these nodules in the alæ of the leaves, or from the impregnated ends of the branches which had received the powder from the capsules, was originally founded on the observing that the trailing or branched hypna annually grew out in length, from the extremities of all their branches, and annually lost as much of the old stalk at the root as they gained of the new at the summit; but it appears from farther observations, that they are real seeds which are contained in form of powder in the capsules; since the brya, and many others, are found growing from small points or spots, which are assemblages of their minute leaves, propagated on the ground, under the old ones just where the powder of the capsules has fallen; and though it be allowed that the hypna and other trailing mosses do grow from the ends of the branches, yet they may also be produced in form of new plants, from regular and perfect seeds shed from the capsules. It is certain that the brya are by this means propagated and spread into large tufts, and the other genera may also be so propagated, though they have beside a property of increasing by growth of the stalk; which seems no other than the property of many of the large plants to creep at the root, and shoot out in length greatly from the extremities of their horizontal branches, lying on or under the ground, as those spreading parts may more properly be so called than roots, the fibres pushed out from them perpendicularly into the earth being properly the roots; and it is well known that these plants, though they propagate themselves thus by the root, produce seeds also like the others, by which they may be equally propagated: and this analogy is to be carried yet farther; for as those plants which creep by the roots produce fewer seeds than those which are propagated only by seeds; so the hypna, which are the genus of mosses in which this growth by the stalk is principally observed, are very thinly beset with capsules of seed, and many of them produce but very few in a season; whereas the brya, and other mosses which have not this advantage of growing from the ends of the stalks, are found every year profusely covered with capsules from every tuft; nay, there is scarce any branch which does not produce its capsule. Now, if these capsules contained only a farina capable of impregnating the nodules or the ends of the branches, it is obvious there would be as much of it required for the hypna as for any other kinds of mosses; but if they are real and perfect seeds, it is no wonder that nature has given them profusely

to

Musci.

to ſuch kinds as are to be propagated only by ſeeds, and more ſparingly to thoſe which are propagated alſo by the increaſe of the branches.

To this it may finally be added, that the ferns and other epiphylloſpermous plants approach moſt of all others to the nature of the moſſes; and though it has been ſuſpected by many that the fine powder at the back of their leaves was not ſeeds, but only a farina, yet it is now well known that it is true and perfect ſeed; ſince, under many ſpecies of them, there are conſtantly found new and ſelf-ſown plants ariſing in their firſt rudiments of leaves and figure, which have plainly grown from the duſt or powder fallen from the old plants; and as this is now found to be the caſe in regard to the ferns, probably it will alſo appear the ſame in regard to moſſes, when they have been yet farther examined than at preſent. But whether theſe grains of powder have the lobes and radicles by which the ſeeds of larger plants propagate themſelves, or whether they grow into plants like the parent ones, in the manner of the lichens, by mere expanſion, is a thing that requires farther obſervation to determine.

Some of the moſſes, it is evident, approach to the nature of the plants which have their male and female parts in the ſame flower, and others to thoſe which have them in different ones.

After all, this tribe of plants, as well as the muſhrooms, ferns, and ſea-weed, is ſtill imperfectly known. Dillenius, profeſſor of botany at Oxford, was the firſt who attempted an arrangement of them. In his *Catalogus Plantarum circa Giſſam*, publiſhed at Francfort in 1719, and afterwards in his *Hiſtoria Muſcorum*, publiſhed at Oxford in 1741, he divides the moſſes into 16 genera. This arrangement, however, includes the lichens, ſome of the fuci, and other plants which belong to very different families. The work in queſtion is, notwithſtanding, valuable, in having introduced the knowledge of upwards of 200 plants, which were unknown before Dillenius: it is, beſides, of all his works of this kind, the beſt executed, both for the deſcriptions and figures, and ſhould ſerve as a model to ſuch authors as intend to publiſh in detail the hiſtory of any particular family of plants.

Micheli, in a work intitled *Nova Plantarum Genera*, publiſhed at Florence in folio in 1629, divides the moſſes into two ſections, from the figure and ſituation of their flowers. Theſe ſections comprehend together 16 genera, amongſt which are improperly arranged, like thoſe of Dillenius, ſeveral of the lichens and other ſea-weed.

The diſcovery of the ſeeds of the moſſes, though made by Dillenius in 1719, is arrogated by Linnæus to himſelf, who did not begin to write till 1735.

In Ray's method, the moſſes form the third claſs: in Tournefort's, they conſtitute a ſingle genus, by the name of *muſcus*, in the firſt ſection of the 17th claſs, which comprehends the moſſes, muſhrooms, and ſome of the algæ or ſea-weed, and is diſtinguiſhed by the name of *aſpermæ*, or plants without ſeed; the ſeeds of the moſſes not having been detected by Tournefort.

The characteriſtics of theſe plants, according to the ſexual ſyſtem, are, 1. Tops without filaments or threads. 2. The male flower, conſtituted by the preſence of the *antheræ* or tops, placed apart from the female, either on the ſame or diſtinct roots. 3. The female flowers deprived of the *piſtillum* or pointal. 4. The ſeeds devoid of both lobes (*cotyledones*) and proper coverings; ſo that they exhibit the naked embryo

In the ſame ſyſtem, theſe plants conſtitute the ſecond order of the claſs *cryptogamia*, which contains all the plants in which the parts of the flower and fruit are wanting, or not conſpicuous. This order is ſubdivided into 13 genera, from the preſence or abſence of the calyx, which in theſe plants is a veil or cover like a monk's cawl, that is placed over the male organs or tops of the ſtamina, and is denominated *calyptra*, from the ſexes of the plants, which bear male and female flowers, ſometimes on the ſame, ſometimes on diſtinct roots; and from the manner of growth of the female flowers, which are ſometimes produced ſingly, ſometimes in bunches or cones. Theſe diſtinctions are moſtly borrowed from Dillenius, whoſe excellence in developing this part of the vegetable kingdom Linnæus very readily acknowledges.

The manner of feeding of moſſes in general may be more clearly underſtood from the deſcription of that genus of them which has been traced through all its ſtages, and to which moſt of the others, though every genus has its diſtinct fructification in ſome reſpects, yet bear a very great general analogy.

The genus already obſerved, is that called by Dr Dillenius the *hypnum*. The ſpecies of this are very numerous and common; but that particular one which was the ſubject of theſe obſervations, is the ſhort-branched ſilky kind, common on old walls; and called by that author in his hiſtory *hypnum, vulgare, ſericum, recurvum, capſulis erectis cuſpidatis*.

The head of this moſs appears to the naked eye a ſmall, ſmooth, browniſh-yellow, oblong body, of about a ninth of an inch long; this is covered at its upper end with a membranaceous calyptra or hood, in ſhape reſembling an extinguiſher or a funnel inverted. When this calyptra is taken off, and the head viewed with a microſcope, the ſurface of it is ſeen to be ridged with longitudinal ſtriæ. The baſis of the head is of a deep orange colour, and more opaque than the reſt; and the top is bounded by an orange-coloured ring, ſwelling out ſomething beyond the ſurface of the contiguous parts of the head. Good glaſſes ſhow that in this head there are not wanting the parts eſſential to the fructification of what are uſually called the more perfect plants. This ring is truly a monophyllous undulated calyx, within which ariſe ſixteen pyramidal fimbriated ſtamina; theſe are of a pale greeniſh colour, and are loaded with a whitiſh oval farina. The ſtamina all bend toward each other from their baſes, and almoſt meet in a point at the tops. This is their appearance when the head is nearly ripe; and immediately under the arch formed by theſe ſtamina, is a cylindric hollow piſtillum, through which the farina makes its way, and is diſperſed among the ſeeds in the head; the fruit is a large capſule, filling every part of the membrane which ſhows itſelf on the outſide of the head, and in moſt places is contiguous to it; this capſule is filled with perfect and very beautiful ſeeds; they are round, tranſparent when unripe, but afterwards opaque, and of a very beautiful green, which colour they retain even when dried.

When this head is firſt produced from the plant, the ſtaminæ are very ſlender, and ſtand erect; the head is

Mufci, Mufcicapa.

is fcarce any thicker than the ftalk, and the calyptra covers it all over, to fhield the tender fubftance of the farina from external injuries. As the farina afterwards fwells in the ftamina, the feeds in the head increafe alfo in bulk, and by their increafe the head is more extended in thicknefs; and the ftamina are by this means feparated farther and farther from each other at their bafes, but bend inwards toward their points, fo as to form a kind of arched covering over the ftigma of the piftillum, which is fingle; and from hence the farina falls as it ripens into the head, and impregnates the feeds.

The 11 principal genera are as follow: *Lycopodium*, *polytricum*, *bryum*, *felagines*, *ufneæ*, *mnium*, *byffi*, *fphagnum*, *hypna*, *confervæ*, and *fontinalis*. Thefe are found growing on the barks of trees as well as on the ground. See Plates CCCXXI and CCCXXII.

Moffes, by the inconfiderate mind, are generally deemed an ufelefs or infignificant part of the creation. That they are not, is evident from hence; that He who made them has made nothing in vain, but on the contrary has pronounced all his works to be very good. Many of their ufes we know; that they have many more which we know not, is unqueftionable, fince there is probably no one thing in the univerfe of which we dare to affert that we know all their ufes. Thus much we are certain of with refpect to moffes, that as they flourifh moft in winter, and at that time cover the ground with a beautiful green carpet, in many places which would be otherwife naked, and when little verdure is elfewhere to be feen; fo at the fame time they fhelter and preferve the feeds, roots, gems, and embryo plants of many vegetables, which would otherwife perifh; they furnifh materials for birds to build their nefts with; they afford a warm winter's retreat for fome quadrupeds, fuch as bears, dormice, and the like, and for numberlefs infects, which are the food of birds and fifhes, and thefe again the food or delight of men. Many of them grow on rocks and barren places, and rotting away, afford the firft principles of vegetation to other plants, which could never elfe have taken root there. Others grow in bogs and marfhes, and by continual increafe and decay fill up and convert them either into fertile paftures, or into peat-bogs, the fource of inexhauftible fuel to the polar regions.—They are applicable alfo to many domeftic purpofes: the lycopodiums are fome of them ufed in dyeing of yarn, and in medicine; the fphagnum and polytrichum furnifh convenient beds for the Laplanders; the hypnums are ufed in tiling of houfes, ftopping crevices in walls, packing up of brittle wares and the roots of plants for diftant conveyance.—To which may be added, that all in general contribute entertainment and agreeable inftruction to the contemplative mind of the naturalift, at a feafon when few other plants offer themfelves to his view.

Musci, is likewife the name of the 56th order in Linnæus's Fragments of a natural Method. See Botany, p 470.

MUSCICAPA, or Fly-catcher, a genus of birds belonging to the order of pafferes. The bill is flatted at the bafe, almoft triangular, notched at the upper mandible, and befet with briftles; the toes (generally) divided as far as their origin.

1. The grifola, or fpotted fly-catcher, is about five inches and three quarters long. The head is large, of a brownifh hue fpotted obfcurely with black: the back is of a moufe-colour: the wings and tail are dufky: the breaft and belly white: the throat and fides under the wings dafhed with red: the legs and feet are fhort and black. It is a bird of paffage; appears here in the fpring, breeds with us, and departs in September. It builds its neft againft any part of a tree that will fupport it; often in the hollow caufed by the decay of fome large limb, hole in a wall, &c. alfo on old pofts and beams of barns; and is found to return to the fame place feafon after feafon. It lays four or five pale eggs marked with reddifh. It feeds on infects, and collects them on the wing. When the young can fly, the old ones withdraw with them into thick woods, where they frolic among the top branches; dropping from the boughs frequently quite perpendicular on the flies that fport beneath, and rifing again in the fame direction. It will alfo take its ftand on the top of fome ftake or poft, from whence it fprings forth on its prey, returning ftill to the fame ftand, for many times together. They feed alfo on cherries, of which they feem very fond.

2. The pondiceriana, Pondicherry or Coromandel fly-catcher, is rather bigger than a fparrow. The general colour of the upper parts is a cinereous grey; the throat, breaft, and belly, white; the legs black. It inhabits the coaft of Coromandel; where, from the agreeablenefs of its fong, it is called the *Indian nightingale*.

3 The flabellifera, or fan-tailed fly-catcher, is in length fix inches and a half: the head is black, which colour defcends on the back part lower than the nape, whence it paffes forward in a narrow collar to the throat; the chin, throat, and fides of the neck, except where this collar paffes, are white; and over the eye is a white ftreak like an eye-brow: the upper parts of the body are olive-brown; the under parts yellowifh ruft, growing whitifh towards the vent: the tail is longer than the body; the two middle feathers black, the others white: the legs are dufky. This fpecies inhabits the fouthern ifle of New Zealand; where it is feen conftantly hunting after infects, and flies always with its tail in fhape of a fan. It is eafily tamed; and will then fit on any perfon's fhoulder, and pick off the flies. It has a chirping kind of note; and is called by the natives *Diggo-wagh-wagh*. There is a beautiful figure of this bird in Mr Latham's Synopfis, plate xlix.

4. The caribonenfis, or cat-bird, is fomewhat bigger than a lark: length eight inches. Bill black: the upper parts of the body and wings are of a deep brown; the under afh-coloured: the crown of the head is black; the tail is blackifh; and the legs are brown. This fpecies is found in Virginia in the fummer-feafon; where it frequents fhrubs rather than tall trees, and feeds on infects: its cry refembles that of a cat, whence the Englifh name given it by Catefby. See Plate CCCXX. fig. 1.

5. The crinita, or crefted fly-catcher, is about the fize of a lark: the head is crefted, and of a dull green: Fig. 2.
the hind part of the neck and back are of the fame colour; the under parts from the chin to the breaft of

of an ash-colour, and from thence to the vent yellow: the legs are black. This inhabits Carolina and Virginia in summer; builds there, and departs in autumn.

Fig. 3. 6. The rubricollus, purple-throated fly-catcher, is about the size of a blackbird: the whole plumage is black; except the chin, throat, and fore part of the neck, on which is a large bed of beautiful crimson, inclining to purple: the legs are black.—These birds inhabit Cayenne and other parts of South America; where they are found in flocks, and precede in general the toucans in their movements. They feed on fruits and insects; and are lively birds, always in action. They for the most part frequent the woods, like the toucans; and where the first are found the others are seldom far off.

7. The rubra, or summer red-bird of Catesby, is a most beautiful species, somewhat bigger than a sparrow: the bill is yellowish; the eyes are black; the legs dusky: the male is wholly of a scarlet colour, except the tips of the quill-feathers, which are of a dusky red: the colour of the female is brown tinged with yellow. It inhabits Carolina and Virginia in the summer.

This is a very numerous genus; there being about 90 other species described by authors. In the *Syst. Nat.* (Gmelin), the whole number is 92; in Mr Latham's *Index Ornithologicus*, 97 are enumerated.

MUSCLE, in anatomy. See ANATOMY, Part II. sect. ii.

The motion of the muscles of animals has been thought a matter of such curiosity and importance, that an annual lecture upon it was founded by Dr Croone, one of the original members of the Royal Society at London. In consequence of this, the investigation of the subject hath exercised the pens of a great number of very learned and ingenious men; notwithstanding which it still remains involved in almost as much obscurity as ever. Many curious observations, however, have been made; and as far as the laws of *dead* mechanism can be applied to a *living* machine, the investigators have been successful: but still there has been a *ne plus ultra*, a certain barrier by which their investigations have been limited, which no person has hitherto been able to pass, and which it is very improbable ever will be passed. To give an account of all the different theories which have appeared on this subject is impossible; but in the year 1788 a lecture on the subject was delivered by Dr Blane, F. R. S. of which, as it seems to contain the substance of all that can be said upon the subject, we shall here give the following abridgement.

The Doctor considers as muscles not only those large masses of flesh which compose so great a part of the bulk of the body, but likewise all the minuter organs subservient to circulation, nutrition, and secretion; since not only the heart itself, but the whole vascular system and the intestines, owe their action to certain powers of irritability and contractility peculiar to muscular fibres.

The first and most obvious considerations with respect to the muscles is the regular organization of their fibres in a parallel direction. In this they are distinguished from every other matter of a fibrous structure, whether vegetable or mineral, by a certain degree of moisture, tenacity, and elasticity, entirely peculiar to themselves.

The fibres of the muscles visible to the naked eye are composed of others discoverable by glasses, and these others of fibres still smaller; neither hath any person been able to discover the ultimately fine fibres of a muscle, which are not composed of others. Some have indeed imagined that they have been able to do this, but their observations have been found fallacious; and it is now universally allowed that the fibres are divisible beyond what the best assisted sight can trace, and that they are to all appearance uniform. In this regular and fibrous organization they resemble the crystals of salts, many of which are found composed of fibres more and more fine, and which, like those of the muscles, can never be ultimately traced.

The doctor next touches a little upon the *vis inertiæ* of matter; and, contrary to the generally received opinion of modern philosophers, considers matter as an active substance. What is called the *vis inertiæ*, he thinks, "is not a resistance of change from rest to motion, or from motion to rest, but a resistance to acceleration or retardation, or to change of direction." The activity of matter is further proved by the attractions and repulsions which take place universally among its parts; and every instance of motion within the cognizance of our senses, may be referred, either in itself or its cause, to some mode of attraction or repulsion. These may both be considered as one principle, being both expressive of that state of activity originally inherent in matter; and because any two particles, having affinity with each other, must either attract or repel, according to their distance, their common temperature, and other circumstances; and it is so universal an agent in nature, that some modern philosophers have made it absorb, as it were, every other power and property in matter. It is evident, however, whether this hypothesis be just or not, that the cause of muscular motion cannot be referred to mechanism, which is itself only a secondary principle. Some have had recourse to a fluid conveyed into the fibres of muscles, by which they were swelled, and thereby shortened. One of the most plausible of these hypotheses supposes this fluid to be the blood: but this is plainly *a petitio principii*; for in order to set the blood in motion, muscular motion is necessary. Other fluids have been supposed to have this effect; but even the existence of these has not been proved, and indeed the most solid objections might be brought against all the theories that have hitherto been invented.

Our author having now established it as a maxim, that the primary properties of matter are attraction and repulsion, and that mechanism is only a secondary property, he next considers muscular motion as referable to an original law of animated matter, whereby its particles are endowed with an attractive power, for which no cause can be assigned any more than for gravitation, cohesion, or chemical affinity. If the shortening of a muscular fibre depends on this increased power of attraction between its particles, the effect will be to add to the power of cohesion in the fibre; and to determine this the Doctor made the following experiment: Having taken the flexor muscle of the thumb of a man newly dead while yet warm and flexible,

Mufcle. ible, he appended a weight to it, continually augmenting it until the mufcle broke; and this he found was done when 26 pounds had been added: yet a living man of the fame apparent ftrength and age could with eafe lift a weight of 38 pounds by the exertions of the famé mufcle. "It is farther in proof of this fact (adds he), that in the cafe of a violent ftrain from mufcular contraction in the living body, it is the tendon that gives way; whereas we have feen that in the dead body the mufcle is the weaker of the two. It is alfo well known, that in cafes of our exertion the mufcular fibres themfelves do not give way, though the ftrongeft tendons, fuch as the tendo Achillis, and even bones, fuch as the knee-pan, are broke by their living force, which in fuch inftances muft be many times greater than the ftrength of the dead fibres. There is a cafe related in the Philofophical Tranfactions by Mr Amyand, wherein the os humeri was broken by an exertion of the mufcles. Every one has heard of fractures happening from very flight accidents. Thefe occur moft probably from a jerk of the mufcles concurring with the external violence. The fenfible increafe of hardnefs in a mufcle, when in a ftate of contraction, may alfo be confidered as a proof of an increafed attraction of its particles to each other at that time."

The Doctor next confiders whether or not a mufcle, when in a ftate of contraction, undergoes any change of denfity. "Every homogeneous body (fays he) poffeffes a certain degree of denfity, determined by the diftance of its integrant particles. The moft common means in nature by which the denfity of fuch bodies is altered are heat and cold; the one univerfally producing expanfion, the other condenfation. Whether mechanical force has the fame effects, is a point in natural philofophy not fo well afcertained; for though tenfion and collifion produce in folid elaftic bodies a change of figure, which they immediately refume when the force is withdrawn, it has not been inquired whether in fuch cafes a change of denfity takes place while the body is in a ftate of elongation or compreffion. Two elaftic balls in the act of collifion undergo a momentary change of figure, fo that there muft be an approximation of particles in the direction in which they are flattened; and in the elongation of an elaftic cord by tenfion there muft be an increafed diftance of the particles in one direction: but while thefe changes take place in one dimenfion of the refpective bodies, they may be compenfated by contrary changes in the other dimenfions, fo that the feveral bodies may preferve, upon the whole, the fame folid contents. In order to afcertain this in the cafe of tenfion, which is the only cafe bearing analogy to mufcular motion, I made the following experiment: I took a piece of the elaftic gum or *caoutchouck*, three inches fquare, and about the eighth of an inch in thicknefs; I procured a piece of fheet tin three inches broad and about fix inches long, cut into fharp teeth at each end. The gum was firft weighed in air, and found to be 380.25 grains. It was then weighed in water along with the tin, to which it was loofely attached, and the weight of both was then 758.75 grains. The gum was then ftretched upon the tin by means of the teeth at each end to a furface of about five inches fquare, the tin being bent fo as to leave a free fpace between it and the gum, in order that when immerfed in water no air-bubbles might be entangled. In this fituation, the weight of both in water was found to be 746.75 grains. Here was a difference of 12 grains, which could be owing only to a diminution of fpecific gravity; and in order to be fure that there was no fallacy nor inaccuracy in the experiment, the gum was immediately difengaged from one end of the tin fo as to allow it to fhrink; and being again weighed in this ftate in the water, it was found to have recovered exactly its former weight." Mufcle.

From this very remarkable experiment, the Doctor argues to what may probably happen in the contraction of the mufcles. "This point (he fays) cannot be decided but by an experimental examination. It might be determined whether a mufcle occupies moft fpace when relaxed or when contracted, by finding its fpecific gravity in each of thofe ftates by means of the hydroftatical balance. But this would be found extremely difficult; for the ftate of contraction is very tranfitory, and the motion itfelf would produce fuch a difturbance as would render the refult unfatisfactory. As there is this obftacle to an experiment on a living mufcle, it occurred to me that it might be performed on the mufcles of a fifh which had undergone the operation of *crimping*, as it is called; for in confequence of dividing the mufcles, by cutting them when alive, they undergo a contraction which continues after death; and upon comparing, by the hydroftatical balance, portions of mufcle which had been crimped with thofe of the oppofite fide of the fame fifh which had on purpofe been faved from this operation, it did not appear that there was any difference in the fpecific gravity. Two trials were made; one with the maffeter mufcles of a fkate, the other with the fides of a large trout."

To determine whether the contraction or relaxation of a living mufcle made any alteration in its denfity, our author took one half of a living eel, and put it into a glafs ftalk, of which the mouth was afterwards fufed by a blow pipe, and drawn out like the ftem of a thermometer. The flafk and tube being then filled with water, our author obferved, with great attention, whether the convulfive agonies of the creature would make the fluid rife or fall; but it did neither. The tail part of the eel was made ufe of in this experiment, that there might be no deception from the other, which contained the organs of refpiration and the air-bladder. In one of his trials, the tail portions of two eels were introduced into the flafk; but though they were frequently both in convulfions at once, not the leaft motion of the fluid in the tube could be perceived. On this occafion alfo the Doctor made fome experiments to decide the queftion, Whether the mere circumftance of *life* made any alteration in the gravity of bodies? His firft trials were with animals of warm blood inclofed in oil-fkin and clofe tin-veffels; but not being fatisfied with the accuracy of thefe, from the difficulty of cutting off all communication with the external air, he inclofed live eels in flafks; and having fealed them hermetically, he found that the weight of them when alive and dead was the very fame.

The refult of all our author's experiments is, that "the contraction of a mufcle produces no change in its denfity, and that animal life differs from inanimate matter in this refpect, as well as in moft of its other properties and laws. One purpofe in nature for mufcles

Muſcle.

always preſerving the ſame denſity may be, that as ſome of them act in confined cavities, inconveniences might ariſe from their occupying more ſpace at one time than at another. In the extremities of cruſtaceous animals, for inſtance, which are filled with muſcles, a change of denſity would be apt to burſt them.

"Another circumſtance in which the contractions of muſcles differ from ſimple elaſticity is, that the former, however frequent and violent, does not produce any heat, as colliſion and tenſion are known to do. This may admit of ſome cavil with regard to animals of warm blood; for one of the theories with regard to animal heat is, that it ariſes from the perpetual vibration of muſcular fibres, particularly thoſe of the vaſcular ſyſtem; but this will not hold with reſpect to animals of cold blood, in which the actions of life are equally vigorous. The principal phenomena, therefore, of muſcular motion are, the ſhortening of the fibres, the lateral ſwell, the increaſe of coheſion and hardneſs, and the unchanged denſity and temperature. It would appear from the two laſt circumſtances, that the intimate motions of the particles in relation to one another muſt be different from what take place in the ſeveral inſtances of contraction and expanſion of dead bodies. In the expanſion ariſing from the action of heat and the contraction from cold, the change of denſity ſhows, that in the one caſe the ultimate particles muſt recede from each other, and in the other they muſt approach. The ſame may be ſaid of elaſticity. But as there is no alteration in the denſity of a muſcle in paſſing from relaxation to contraction, this change cannot conſiſt in the approximation of the integrant parts of the fibres, but muſt depend on ſome other circumſtances in the intimate diſpoſitions of the particles. In attempting to conceive in what this conſiſts, the following explanation may be offered. It is probable that the regular ſtructure of ſolid bodies depends on the polarity and ſhape of their integrant parts. Now all bodies, except ſuch as are ſpherical, muſt have a long and a ſhort axis; and let us imagine the fibres of muſcles to be compoſed of ſpheroidal particles, we may then conceive relaxation to conſiſt in their being diſpoſed with their long axis in the line of their fibres, and contraction to conſiſt in their ſhort axis being diſpoſed more or leſs in that direction. This will not only account for the decurtation and uniform denſity, but for the lateral ſwell, and alſo for the increaſed hardneſs and coheſion; for though the particles do not approach or recede, as in bodies ſimply elaſtic, yet their power of attraction will be increaſed by their centres being brought nearer, and by being applied to each other by more oblate ſurfaces. This hypotheſis accords with what has been before proved concerning the unchangeable denſity, for what is loſt in one dimenſion is gained in another; and the cauſe for there being no increaſe in temperature depends probably on the ſame circumſtance by which the denſity is preſerved unaltered."

Thus far the Doctor has proceeded upon a plan, which may become plauſible by means of an hypotheſis at leaſt; but in the proſecution of his ſubject he is involved in the ſame difficulty which has proved too hard for every other perſon, and which he, indeed, does not attempt to ſolve. This is the action of ſtimuli, by which the muſcles are exerted to contraction, and upon which all the phenomena of life depends, and which indeed is the thing that particularly ought to be explained; but of this our author is forced to confeſs his entire ignorance, and to content himſelf with enumerating the ſtimuli of which he cannot explain the action. Stimuli then, according to him, are divided into internal and external. An example of the former kind is the circulation of the blood, which is kept up by an exciting influence of the blood upon the heart and veſſels which contain and impel it. The earlieſt perceivable inſtance of muſcular motion is the beating of the heart, as it is ſeen in the firſt rudiments of the embryo in an egg, and called the *punctum ſaliens*. There ſeems to be eſtabliſhed by nature a certain habitude of action between the veſſels and their fluids; for if a fluid even more mild than the blood, ſuch as milk, be injected into the circulation, it will produce great diſturbance; and if the blood, by being deprived of the influence of reſpirable air, becomes deſtitute of a certain property which it would naturally acquire in the act of reſpiration, it does not prove a ſtimulus to the heart.

In like manner, all the containing parts are accommodated to the nature of their reſpective contents.—The inteſtines are ſo calculated as to have proper motions excited in them by the aliment and the ſecretions which are mixed with it; and there are bodies which, though perfectly mild, ſuch as alimentary ſubſtances of difficult digeſtion, yet excite more violent commotions in the ſtomach than other ſubſtances which are very acrimonious. The various effects of poiſons in different parts of the body may alſo be mentioned as an illuſtration of the peculiar ſuſceptibility of the ſeveral organs of the body. The poiſon of a viper, for inſtance, is perfectly innocent, not only in the receptacles of the animal which produces it, but may be taken into the ſtomach of any animal without the leaſt bad effect, and only exerts its deleterious power when brought in contact with a wounded part. Some vegetable poiſons, on the contrary, ſuch as that of laurel water, prove deadly when taken into the mouth, or applied to any part of the alimentary canal, but are innocent when injected into the veins. It may be remarked alſo, that the receptacles of the ſeveral ſecreted fluids, ſuch as the gall-bladder and bladder of urine, are ſo adapted to their natural contents, by a due meaſure of irritability, as to bear their accumulation to a certain degree, and then to expel them. We have here alſo a proof that irritability is not in proportion to ſenſibility; for both theſe receptacles are extremely ſenſible to pain and irritation from extraneous acrimony, though ſo moderately ſenſible to the acrimony of their natural contents. This diſpoſition in the ſeveral organs to perform their natural functions, in conſequence of the ſtimulus of the reſpective fluids they contain, has aptly enough been called the natural perception of theſe organs.

Our author now conſidering that the internal organs are calculated to perform their functions in conſequence of certain ſtimuli, concludes the application of chemical and mechanical ſtimuli is not a mode of experiment likely to produce uſeful knowledge; and hence, he thinks, we may ſuggeſt the moſt likely means of reſtoring loſt irritability and action to the vital functions, when ſuſpended by ſuffocation, ſtrangulation, or immerſion. In theſe caſes, he ſays, that all other means are far inferior to that of inflating the lungs with

with atmospheric air, and stroking and pressing the ribs in such a manner as to imitate natural respiration. The only other thing which he supposes to be any way useful, is the application of heat to such as have been immersed in cold water; but of cool air to those who have suffered from mephitic vapours.

The Doctor having then considered some other parts of the animal economy, enters into an investigation of the analogy between motion and sensation. "This analogy (says he) is the more exact, that the nerves seem to be the instruments of both; for not only the organs of sensation and voluntary motion, but those of involuntary motion, are supplied with nerves, and dependant upon them; for if the influence of the nerves leading to the heart or intestines is interrupted by cutting, ligature, or palsy, the function of these parts is thereby destroyed. Thus, as there is a peculiar sensibility belonging to the several senses, so is there a peculiar irritability belonging to the several organs of motion. The intention of nature, therefore, in distinguishing nerves to every muscular organ, was probably in order to constitute those peculiar perceptions on which the various vital and natural functions depend. But I give this only as a conjecture; and though the nervous influence may thus *modify* irritability, there is reason to think that it does not *bestow* it."

Our author controverts the principle which has been held by some very able physiologists, that all muscular irritability depends upon a sentient principle. "There have been several instances (says he) of the production of fœtuses without the brain; and a principal fact in support of this opinion is, the existence of animals without brain or nerves. That there are such, was, I believe, first observed by Haller, and has been confirmed by Mr Hunter; who maintains farther, that the stomach is a centre or seat of life more essential to it than the brain. That the stomach should be an organ of so much consequence, seems natural enough from the importance of its function, which is that of assimilation; and life can be more immediately and completely extinguished by an injury to it, such as a blow, than by the same violence to any other part of the body. It is also well known, that the muscular fibres of animals endowed with a nervous system, will retain their irritability for some time after their separation from the brain and nerves.—It is evident likewise, from the phenomena of vegetation, that irritability may exist in nature without sensation, consciousness, or any suspicion of the existence of a nervous system. In favour of this opinion, it is farther observable, that those animals which are destitute of brain and nerves are of the class of *vermes*, the most simple in nature, having only one function, viz. that of assimilation; and therefore not requiring that variety of action, and those perceptions which are peculiar to more complex animals. Lastly, the state of an egg before incubation, and the condition of those animals which become torpid from cold, and afterwards revive, afford facts which favour this opinion; as they show that there is a certain principle of self-preservation, independent not only of the operation of the nervous system, but even of the circulation; for in this quiescent state, those portions of animal matter are preserved for a great length of time from that corruption to which they would otherwise be liable, and their fluids are prevented from freezing in a degree of cold which would congeal them, were they destitute of every principle of life."

In the course of his reasoning, our author considers the nervous system not only as a mere appendage to life, but as tending to impede its operation, and shorten its existence. "Simple life (adds he) will not only survive sensation, but will survive it longer, if the animal is killed by destroying the nervous system, than if it had been destroyed by hæmorrhagy, suffocation, or other violence. If a fish, immediately upon being taken out of the water, be stunned by a violent blow on the head, or by having the head crushed, the irritability and sweetness of the muscles will be preserved much longer than if it had been allowed to die with the organs of sense entire. This is so well known to fishermen, that they put it in practice in order to make them longer susceptible of the operation called *crimping*. A salmon is one of the fishes least tenacious of life, insomuch that it will lose all signs of life in less than half an hour after it is taken out of the water, if suffered to die without any farther injury; but if, immediately after being caught, it receives a violent blow on the head, the muscles will show visible irritability for more than 12 hours afterwards."

To the same purpose, our author observes, that in warm-blooded animals an excessive exertion of voluntary motion immediately before death, prevents the muscles from being rigid when cold, and renders them more prone to putrefaction. Thus, if an ox is killed immediately after being overdrove, the carcase will not become stiff when it grows cold, nor is it capable of being preserved by means of salt. In confirmation of the same hypothesis also, our author observes, that in some disorders of the brain, such as hydrocephalus, and apoplectic palsy, in which the functions of the brain are suspended, the office of digestion is sometimes better performed than in health.

From all this our author concludes, along with Mr Hunter, that the exercise of sensation is inimical to life, and that a sort of fatigue is induced by this as well as by voluntary motion; "so that all that intercourse carried on through the nerves, whether *towards* the brain in the case of sensation, or *from* the brain in acts of volition, tends to wear out the animal powers. And, as intense and long-continued thought, though not terminating in any outward action, tends also to produce an inability for farther exertions, it would appear that the brain or sensorium is more particularly the organ which is subject to that species of sufferance called *fatigue*. From these facts we perceive the necessity of sleep, which consists in a temporary suspension of sensation, volition, and thought, and is a resource of nature, whereby the powers of life recover themselves after satiety and fatigue, which are provided as guards to warn us when nature is in danger of being strained, either by repletion or over-exertion; and it is evident that such barriers were absolutely necessary, in order to set bounds to operations which are only occasionally requisite, and which would otherwise depend on the caprice of the will. The exercise of sensation and voluntary motion in a moderate degree is conformable to the intention of nature, and therefore salutary; and it is only when they are excessive

ceſſive that they tend to wear out the powers of life, and more eſpecially if theſe are not duly recruited by ſleep. It follows, from the ſame principle, that when life is threatened by certain diſeaſes, of which the chief ſymptom is irritation, any means by which ſenſation, whether natural or morbid, and muſcular motion, whether voluntary or involuntary, convulſive or ſpaſmodic, can be ſoothed or ſuſpended, will prove ſalutary, by allowing the powers of life to rally as it were, and to recover themſelves. In this conſiſts the operation of narcotic medicines, ſuch as opium;—which, in complaints both of a general and local nature, proves uſeful, not merely as a palliative by the removal of temporary pain or ſpaſm, or by procuring ſleep, but as a principal inſtrument of recovery, by allowing the powers of life to exert their natural action, in conſequence of the removal of irritation."

In treating this ſubject, the Doctor conſiders the effects of opium as affecting ſimple or ſenſitive life; and to determine this, he made the following experiments: Having made a ſolution of opium in water, he put into one portion of it ſome ſound living eels, and others with their heads bruiſed; and in a number of trials it was found that the ſound eels generally died much ſooner than the bruiſed ones. This, however was the caſe only when the ſolution was of a certain degree of ſtrength, ſuch as half a grain of opium at leaſt to an ounce of water; for when only about half this ſtrength, the ſound eels lived much longer, the time being then protracted to that in which the bruiſed eels would have died merely in conſequence of their injury; but it muſt be obſerved, that even the wounded eels died conſiderably ſooner than when put into plain water.

From all this, our author concludes, that "the great maſſes of muſcle in the trunk and extremities of the body are the inſtruments of the mind in acting upon external bodies; and we may therefore rank in the liſt of ſtimuli the nervous power by which the will and the paſſions excite external motions. This is a function ſufficiently important for the nerves, without admitting them as the principle on which irritability depends."

Having diſclaimed all inquiry into the connection between muſcular motion and volition, the Doctor proceeds to conſider the effects of the different paſſions upon the muſcles. Though theſe are diſtinct from the motions directly produced by the will, yet he conſiders them among thoſe ariſing from conſciouſneſs; "for there are emotions of the heart which have viſible and powerful effects upon the mind and vaſcular ſyſtem, which are organs entirely out of the reach of the will. Not to mention the well-known effects of grief, fear, and joy, which affect the whole circulation, there are certain paſſions and ſentiments which produce partial and local effects. Theſe are eſtabliſhed by nature, either to anſwer ſome important purpoſe in nature, as in the caſe of the congeſtion of the fluids in the parts of generation in conſequence of the venereal appetite, or to ſerve as natural expreſſions, as in the caſe of bluſhing or weeping. One of the moſt ſtriking effects of the paſſions upon muſcular action, is the influence they have upon the ſtrength or mechanical force of the voluntary muſcles. Fear produces debility almoſt amounting to palſy. Courage and order of mind, on the contrary, add to the natural ſtrength. When the mind is agitated by ſome intereſting object, and calls upon the body for an extraordinary exertion to effect its end, the muſcles are thereby enabled, as it were by magic, to perform acts of ſtrength of which they would be entirely incapable in cold-blood. In circumſtances of danger, for inſtance, where life or honour are at ſtake, exertions are made for overcoming mechanical reſiſtance which ſeem incredible, and would be impoſſible, were not the mind in a ſort of phrenzy; and it is truly admirable in the economy of nature, that an idea in the mind ſhould thus in a moment augment the powers of motion, and inſpire additional reſources of ſtrength adequate to the occaſional calls of life. The great increaſe of ſtrength in maniacs is alſo referable to the paſſions of the mind. Theſe conſiderations would almoſt lead us to doubt whether or not the accounts we have of the great feats of ſtrength aſcribed to individuals in the heroic ages be fabulous or not. It is alſo worthy of remark, that, in great and laſting exertions of ſtrength to which men are impelled by active and generous affections, fatigue is not induced in the ſame proportion by many degrees as by the ſame quantity of muſcular action in the cool and deliberate actions of common life."

Having thus diſcuſſed the ſubject of *internal* ſtimuli, our author next proceeds to take notice of the ſecond claſs, viz. ſuch as are *external.* Theſe are either immediate or remote, viz. ſuch as are excited by mechanical means, or by acrimony directly and artificially applied to a muſcular fibre; or ſuch as occur in the inſtances of ſympathy, and in the caſe of thoſe inſtincts which nature has inſtituted for the purpoſe of ſelf-preſervation in brutes, and in the early part of human life. "There are certain habitudes (ſays he) between outward ſtimuli and the moving powers whereby natural propenſities are conſtituted, equally neceſſary to the ſupport of life as the internal functions. Thus, in a new born animal, the firſt contact of the external air excites the act of reſpiration, and the contact of the nipple excites the act of ſucking; both of which actions are abſolutely neceſſary to the maintenance of life, and require the nice co-operation of a great number of muſcles prior to all experience. Actions of this kind are called *inſtinctive;* but though different from thoſe of voluntary motion, they nevertheleſs run into one another; ſo that what was at firſt merely inſtinctive, may afterwards become a matter of deliberate choice. The ſame muſcles are the inſtruments of both; and they differ from the muſcles obeying the internal ſtimuli, ſuch as the heart, in being liable to fatigue, and thereby concurring with the exerciſe of ſenſation and of thought, in rendering ſleep neceſſary. There are no muſcles except thoſe of reſpiration, of which the conſtant action is neceſſary to life, and which are void of conſciouſneſs in their ordinary exerciſe, but which are yet in ſome meaſure under the controul of the will. The principal end anſwered by this power of the will over the muſcles of reſpiration in man, is to form and regulate the voice. But, though inſtinctive motions are in ſome caſes convertible into thoſe which are voluntary, they ought by no means to be confounded together; for even thoſe animals which are deſtitute of brain and nerves, are capable of actions evidently of the inſtinctive kind.—

A leech

Muscle. A leech, for inſtance, being brought into contact with a living animal, is impelled by an inſtinct of its nature to faſten upon it, and ſuck its blood. There is ſomething very ſimilar to this even in vegetables, as in the caſe of tendrils and creeping plants being ſtimulated by the contact of other bodies to cling round them in a particular direction ‡.

‡ See *Vegetable Motion*.

Beſides theſe obſervations on the inferior animals, our author brings ſome experiments to ſhow, that inſtinctive actions, even in animals furniſhed with a brain and nerves, do not depend on ſenſation. Having divided the ſpinal marrow of a live kitten a few days old, he irritated the hind-paws by touching them with a hot wire. By this the muſcles of the poſterior extremities were thrown into contractions, ſo as to produce the motion of ſhrinking from the injury; and the ſame effects were obſerved in another kitten of which the head was entirely ſeparated from the body. In repeating this experiment he found, that when the ſpinal marrow was cut through between the lumbar vertebræ and os ſacrum, the poſterior extremities loſt their irritability, but the tail reſumed it. Even the head retained its irritability after it was cut off; as appeared by touching the ears with a hot wire, or by pricking them: "and (ſays our author) as the extremities are alſo irritable, it will not be ſaid that conſcioufneſs and ſenſation exiſt in two ſeparated portions of the body."

The effects of habit are then conſidered; and the concluſion from the doctor's reaſoning upon this ſubject is, that "there is a *co-ordinance*, or pre-eſtabliſhed harmony, as it were, between the faculties of animals and the laws of external matter, which is the foundation of all the inſtinctive habits of animals, as well as the rational conduct of man."

To the law of habit have been referred the effects of certain contagions, ſuch as that of the ſmall-pox, which do not produce their effect more than once in life. With reſpect to this he obſerves, "that upon whatever principle this property of the animal economy depends, it is an undoubted fact, that theſe morbid poiſons, after exciting a certain degree of diſturbance, and a certain ſeries of diſeaſed actions, no longer make any impreſſion on the powers of life, otherwiſe there could be no ſuch thing as recovery: for at the time in which a perſon begins to recover from the ſmall-pox, the poiſon actually preſent in the circulating ſyſtem is multiplied infinitely beyond what it was when it excited the diſeaſe. The conſtitution has therefore at that time, with reſpect to this acrimony, acquired an inſenſibility, or rather want of irritability; and this it preſerves ever afterwards. This, however, holds only with regard to thoſe morbid poiſons which excite febrile affections, and ſeems to be a neceſſary proviſion of nature to guard againſt ſuch noxious principles as are generated within the body itſelf."

Having laſtly conſidered the effects of *irritation* upon the human body, the Doctor goes on to conſider a very remarkable property of living muſcles, viz. that of their being in a conſtant ſtate of tenſion, more or leſs, independent of any temporary ſtimulus. This is evident from what happens when any muſcle is cut; for then there is an immediate retraction of the ſeparated parts; and that this is their natural ſtate is farther proved by the ſpontaneous motion which takes place in conſequence of the relaxation of an antagoniſt muſcle, as when the mouth is drawn to one ſide in conſequence of hemiplegia. Some degree of tenſion indeed is neceſſary for the performance of the natural motions of the muſcles, whether voluntary or involuntary; and the vigour with which the ſeveral actions are performed depends on the due degree of this tone.

Muſcle.

This tone of the muſcles is every where maintained by a certain counteracting mechanical power: the great muſcles are kept on the ſtretch by the bones, the heart and veſſels by the maſs of fluids, and the inteſtines by the aliments taken in, and their other contents. Diſeaſes of various kinds may ariſe from the different degrees of this tenſion, and the vaſcular ſyſtem is more apt to be affected by different degrees of tenſion than any other part of the body; and our author conſiders what is called a *nervous* habit as one of the effects of want of tenſion. He likewiſe attributes to the different degrees of tenſion, more than to any thing elſe, the great difference of conſtitutions obſervable among mankind. He obſerves alſo, that the tenſion of the muſcles is greatly affected by ſympathy. "This (ſays he) is particularly obſerved in the blood-veſſels and inteſtines; for a relaxation in theſe will produce a like affection in every other part of the animal ſyſtem. With regard to the inteſtines, it may be mentioned among other proofs, that it is common for perſons in a ſtate of great weakneſs to be affected by ſyncope, and even inſtantaneous death, in the act of evacuating the bowels. It ſeems to be from a like cauſe that a temporary lowneſs is produced by an abſceſs being opened.

The Doctor concludes his ſubject with conſidering the muſcles as mechanical powers. "As they conſtitute the ſtrength of animals, it may be proper to conſider the relation of their ſtrength to their bulk, and the relation of the bulk and ſtrength of the body to the denſity and coheſion of its own materials; and to the bulk, denſity, and coheſion of the external inanimate bodies with which it is converſant.

"It has been demonſtrated by Galileo, that in ſimilar unequal bodies, of a cylindrical or priſmatic ſhape, ſuch as the limbs of animals nearly are, the ratio of their efforts to break by their own weight is in the quadruplicate ratio of their lengths; but that the reſiſtance they make to the ſame force is only in the triplicate ratio of their lengths. It follows from this, that in order to endow the limbs of animals with the ſame relative force, it is not only neceſſary that the bones ſhould poſſeſs an increaſed proportion of thickneſs, in order to give an adequate increaſe of what may be called the dead ſtrength; but a ſimilar increaſe of living ſtrength is neceſſary, by a ſuitable addition of muſcular power, in order to keep pace with the increaſed ſize of the bones. Now we obſerve, in fact, that in the large-ſized animals, ſuch as the bull and the elephant, the thickneſs both of their bones and muſcles becomes greater in proportion to the length of their limbs than in the ſmaller animals, and they are therefore of a leſs elegant form. But nature has not carried this ſo far as to compenſate for the diſadvantage ariſing from the increaſe of ſize; for the greater animals have not the ſame proportional ſtrength, in relation to their bulk, that the ſmaller animals have. It has been computed that a flea can draw from 70 to

to 80 times its own weight, whereas a horſe cannot with eaſe draw more than three times his own weight. This diſproportion between ſize and ſtrength is very obſervable in different individuals of the human ſpecies; for tall men are not muſcular, even in the ſimple proportion of their ſtature."

Our author now proceeds to aſſign ſome reaſons why the ſtature of mankind in general is not larger than we ſee it. Some obſervations upon this ſubject are made under the article GIANT, where it is attempted to ſhow, that by increaſing the proportional ſtrength of the materials, the ſize of the human body might have been augmented in any proportion. To this, however, the Doctor replies, that "had the bones been harder, they would not have been calculated for the common duration of life, the effect of which being to increaſe their hardneſs and dryneſs, they muſt be endowed originally with a certain degree of ſoftneſs and ſucculence: and, with regard to muſcles, a degree of hardneſs much greater than they poſſeſs would have been incompatible with their contractility." But this reaſoning does not ſeem to be concluſive. The bones of a lion are ſaid to be much harder than thoſe of any other animal; yet we do not find that theſe creatures are liable to any kind of diſeaſe in conſequence of this ſuperior hardneſs. Neither is any inconvenient degree of hardneſs in the muſcles a neceſſary conſequence of their increaſed ſtrength; for ſilk, though equally ſoft and flexible, nay much more ſo than hemp or flax, is nevertheleſs much ſtronger; and we cannot by any means doubt, that if men had formerly been of a larger ſtature than they are at preſent, the materials of their bones and muſcles might have been proportionably ſtronger, without the leaſt injury or impediment to any of the operations of life.

When we conſider the manner in which the muſcles act upon the bones into which they are inſerted, we may be apt to think that nature has been very prodigal of mechanical power; for, conſidering the bones as levers, the muſcles act upon them at a very great diſadvantage, being always inſerted much nearer the fulcrum than the weight to be raiſed. Thus the two muſcles of the arm, named *biceps* and *brachiæus internus*, in order to ſupport in the hand a weight of one pound with the fore-arm at right angles to the humerus, muſt exert a power equal to ten pounds. Another circumſtance alſo which tends to waſte the power, is the obliquity with which they are inſerted into their bones; ſo that the greater part of the force is expended in preſſing one bone againſt another at the articulation, and only a ſmall part of it in making the flexures and extenſions. Theſe diſadvantages, however, are compenſated by a number of conveniences which could not have been obtained on any other plan. We muſt diſtinguiſh between thoſe actions which conſiſt in preſſure and thoſe which depend on percuſſion; for as the momentum of this laſt depends on velocity, it is evident that there muſt be a great advantage from the inſertion of the tendon being near the centre of motion, as greater velocity with leſs expence of contraction will thus be communicated to the extremity. The muſcles, for inſtance, which are attached to the *olecranon*, in performing thoſe actions with the hand which require rubbing, act with a diſadvantage exactly proportional to the inequality of the diſtance from their inſertion to the joint of the elbow, and that from the ſame joint to the hand. This is an act of preſſure. But in the caſe of percuſſion, as in the action of uſing a hammer, there is an evident advantage reſulting from the velocity communicated to the extremity; for, in order to have produced the ſame velocity, with the inſertion at a greater diſtance from the centre of motion, a much greater degree of contraction would have been neceſſary; and our author ſhows that fatigue principally depends on a contraction of the muſcles. "If any one (ſays he) will take the trouble of comparing the fatigue of the biceps muſcle, in bearing a weight in the hand with the elbow joint bent to a right angle, with that of bearing the ſame weight for the ſame length of time with the joint at an acute angle, he will be ſenſible how much the degree of fatigue depends on the extent of contraction; and, by attending to the relative ſituation of muſcular fibres, it will appear, that Nature, in diſtributing the fibres of muſcles obliquely, has had it in view not only to increaſe their number, but to ſave contraction."

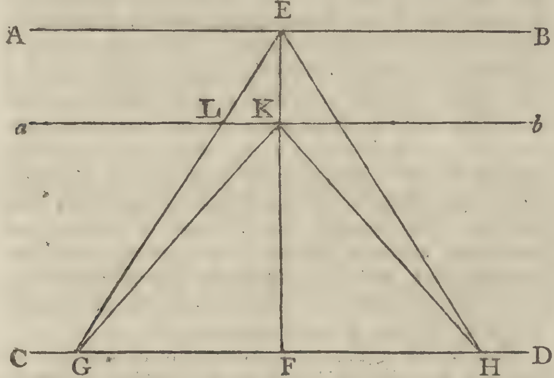
In conſidering the actions of the various muſcles in producing the different actions of the body, we find ſcarce one produced that can be called direct. In ſome inſtances we find two muſcles, or two ſets of muſcles, co-operating, ſo that the motion effected by them ſhall be in the diagonal of their direction. This is the caſe of the oblique muſcles of the abdomen in ſome of their actions, and of the intercoſtal muſcles in all theirs. Sometimes different portions of the ſame muſcle combine in like manner to produce a ſimilar effect; and in all the long muſcles, however ſimple their origin and inſertion may be, there is an internal obliquity of their fibres with regard to one another; for theſe do not run from end to end, but there are parts of the tendon running into the belly of the muſcle, ſo as to divide it into penniform and rhomboidal portions. This diſtribution of the fibres takes off from the length; but as it takes place in thoſe caſes where the origin and inſertion are at a conſiderable diſtance, this can be afforded; and this, as well as the waſte of power, in conſequence of oblique action, is more than compenſated by the increaſed ſtrength from the fibres being multiplied; for, in conſequence of this ſtructure, there is an extent of tendon afforded ſufficient for the inſertion of a greater number of fleſhy fibres.

The Doctor illuſtrates this principle in the mechaniſm of muſcular action from the example of fiſh; a ſpecies of animals which exert greater muſcular powers than any others. "The muſcles of moſt fiſh (ſays he) conſiſt of regular ſeries of oblique ſhort fibres, forming thoſe ſtrata which every one muſt have obſerved in their muſcular ſubſtance. Their motions are more ſimple and limited than thoſe of land-animals, but much more vigorous; for a fiſh in the ſea has to make its way through a medium about 1000 times more denſe than air, and with more rapidity than thoſe which inhabit the land. Nature, therefore, inſtead of giving them muſcles whoſe fibres would run ſtraight from one end of their body to the other, has multiplied their numbers, by diſtributing them into ſhort and oblique portions. I have ſeen the ſword of a ſword-fiſh ſticking in a plank, which it had penetrated from ſide to ſide; and when it is conſidered that

Muscle.

that the animal was then moving through so dense a medium, and in the same direction with the ship, we must form a high conception of its muscular power."

Lastly, our author gives a mathematical demonstration, that by the obliquity of the muscles a very considerable quantity of contraction is saved, and consequently a proportional degree of fatigue prevented.—"Let the line AB (says he) in the annexed diagram, represent a moveable bone, and the line CD a fixed bone parallel to it. Let FE, perpendicular to these lines, represent a muscle acting in its own direction, and the lines GE, HE, represent two muscles acting obliquely, and producing by a diagonal action the same effect as the other. If the bone AB be brought to the situation $a\,b$ by the action of the muscle FE, the muscle will then be in the situation FK. If the bone is brought into the same situation by the action of the muscles GE, HE, these muscles will then be in the situation GK, HK.



"The proposition to be demonstrated is, that the line GK bears a greater proportion to the line GE, than the line FK does to line FE; for FK is to FE as GL is to GE (Euc. Elem. B. vi Prop. 2.); and the angle ELK being less than a right angle, the angle GLK, which is adjacent to it, must be greater than a right angle; and the angle GKL being in the same triangle with GLK, must be less than a right angle. The line GK, therefore, which subtends the greater angle, is greater than the line GL, subtending the lesser, and therefore bears a greater proportion to GE. But the line GL is to GE as FK is to FE; and therefore GK bears a greater proportion to GE than FK does to FE; that is, the fibres of the muscles acting obliquely, suffer a less proportional decurtation than those of the muscle acting directly.

"It is farther obvious, that the more oblique the action becomes, the greater saving there will be of contraction; for in moving the line $a\,b$ towards CD, the line FK diminishes in a swifter ratio than the line GK; and when the former has vanished, the latter is in the situation GF."

Besides these advantages in point of diminishing fatigue, there are others relating to the shape of the members. Thus, if the insertions of the muscles had been at a great distance from the joints, they must upon every occasion have passed like bow-strings from one bow to the other, and the limbs must have been exceedingly clumsy and unwieldy; all the motions must also have been extremely slow: and notwithstanding the superior strength which people would then have enjoyed, it is very plain that they would scarce have been fit for any of the offices of life which they now perform.

Muscle || Muses.

MUSCLE, in zoology. See MYTULUS.

MUSCOVY. See RUSSIA.

Muscovy-Glass, or GLIMMER. See MICA.

MUSCULUS, a military machine, made use of by the Romans to cover and protect the soldiers while they approached and undermined the walls of besieged places, or filled the ditches. It seems to have resembled the testudo in form, but was smaller in size. See TESTUDO.

MUSEIA, were Grecian festivals in honour of the Muses, celebrated with games every fifth year, particularly by the Thespians. The Macedonians also observed a festival of the same name in honour of Jupiter and the Muses, which lasted for nine days, and was celebrated with stage plays, songs, and poetical compositions.

MUSES, certain fabulous deities among the Pagans, supposed to preside over the arts and sciences: for this reason it is usual for the poets, at the beginning of a poem, to invoke these goddesses to their aid.

The muses were originally only singers and musicians in the service of Osiris, or the great Egyptian Bacchus, under the instruction and guidance of his son Orus; but in succeeding times they were called the *daughters of Jupiter and Mnemosyne* or *Memory*.

These are the only pagan divinities whose worship has been continued through all succeeding changes in the religion and sentiments of mankind. Professors of every liberal art in all the countries of Europe still revere them; particularly the poets, who seldom undertake the slightest work without invoking their aid.

Sir Isaac Newton tells us, that the singing women of Osiris were celebrated in Thrace by the name of the *Muses*; and that the daughters of Pierius, a Thracian, imitating them, were celebrated by the same name.

Diodorus Siculus informs us, that Alcman of Messene, a lyric poet who flourished in the 27th Olympiad, 670 years B. C. makes them the daughters of Uranus and Terra. It has been asserted by some ancient writers, that at first they were only three in number; but Homer, Hesiod, and other profound mythologists, admit of nine (A).

In his hymn to Apollo, Homer says,

——By turns the *nine* delight to sing.

And Hesiod, in his theogony, names them all.—They are said severally to preside over some art or science, as music, poetry, dancing, astronomy. By some they are called *virgins*, because the virtues of education appear unalterable: they are called *muses* from a Greek word which signifies to explain mysteries, because they have taught things the most curious and

Burney's Hist. of Mus.

(A) It has been said, that when the citizens of Sicyon directed three skilful statuaries to make each of them statues of the three Muses, they were all so well executed, that they did not know which to choose, but erected all the nine, and that Hesiod and Homer only gave them names.

Muses.

and important to know, and which are above the comprehension of vulgar minds. Each of their names is said to include some particular allegory; *Clio*, for instance, has been thus called, because those who are praised in verse acquire immortal fame; *Euterpe*, on account of the pleasure accruing to those who hear learned poetry; *Thalia* implies for ever flourishing; *Melpomene*, that her melody insinuates itself into the inmost recesses of the soul; *Terpsichore* marks the pleasure which those receive who are versed in the liberal arts; *Erato* seems to indicate, that the learned command the esteem and friendship of all mankind; *Polyphymnia*, that many poets are become immortal by the number of hymns which they have addressed to the gods; *Urania*, that those whom she instructs elevate their contemplations and celebrity to the heavens and the stars; and lastly, the exquisite voice of *Calliope* has acquired her that appellation, as the inventress and guardian of eloquence and rhetoric.

An epigram of Callimachus gives the attributes of the muses in as many lines.

Calliope the deeds of heroes sings;
Great *Clio* sweeps to history the strings;
Euterpe teaches mimes their silent show;
Melpomene presides o'er scenes of wo;
Terpsichore the flute's soft pow'r displays;
And *Erato* gives hymns the gods to praise;
Polymnia's skill inspires melodious strains;
Urania wise, the starry course explains;
And gay *Thalia's* glass points out where folly reigns.

This epigram does not, however, exactly correspond with the ideas of other poets, or of the ancient painters, in characterising the attributes of the muses. The ancients had numberless ingenious and fanciful ideas concerning the muses, which we have not room to recite.—"It seems (says the Abbe Barthelemi *) as if the first poets, enchanted with the beauties of nature, occasionally were led to invoke the nymphs of the woods, hills, and fountains; and that yielding to the prevailing taste for allegory, they gave them names relative to the influence they might be supposed to have over the productions of the mind. At first three muses only were admitted, Melete, Mneme, and Aœde: that is to say, the meditation or reflection necessary to study; memory which records illustrious deeds; and song which accompanies their recital. In proportion as improvement was made in the art of versification, its characters and effects were personified, the number of the muses increased, and the names they now received referred to the charms of poetry, its celestial origin, the beauty of its language, the pleasure and gaiety it inspires, the song and dance which add to it new charms, and the glory with which it is crowned. Afterwards were associated with them the Graces, whose employment it is to embellish poetry, and Love who is so frequently its object. These ideas took birth in a barbarous country, in Thrace, where Orpheus, Linus, and their disciples, suddenly appeared in the midst of ignorance. The muses were honoured there on the Pierian mount, and extending their dominion, successively took their stations on Pindus, Parnassus, Helicon, and all those solitary places where the painters of nature, surrounded by the most pleasing images, experience the divine glow of inspiration."

* *Travels of Anacharses*, vol. iii. p. 261.

Pythagoras, and afterwards Plato, make the muses the soul of the planets in our system; from whence the imaginary music of the spheres.

Museum || Mushroom.

MUSEUM, a name which originally signified a part of the palace of Alexandria, which took up at least one-fourth of the city. This quarter was called the *museum*, on account of its being set apart for the muses and the study of the sciences. Here were lodged and entertained the men of learning; who were divided into many companies or colleges, according to the sciences of which they were the professors; and to each of these houses or colleges was allotted a handsome revenue. The foundation of this establishment is attributed to Ptolemy Philadelphus, who here placed his library. Hence the word *museum* is now applied to any place set apart as a repository for things that have an immediate relation to the arts.

The museum at Oxford, called the *Ashmolean museum*, is a noble pile of building, erected at the expence of the university, at the west end of the theatre, at which side it has a magnificent portal, sustained by pillars of the Corinthian order. The front, which is to the street, extends about 60 feet, where there is this inscription over the entrance in gilt characters, *Museum Ashmoleanum, schola naturalis historiæ, officina chymicha*. It was begun in 1679, and finished in 1683, when a valuable collection of curiosities was presented to the university by Elias Ashmole, Esq; which were the same day reposited there: several accessions have been since made to the museum; among which are hieroglyphics, and other Egyptian antiquities, an entire mummy, Roman antiquities, altars, medals, lamps, &c. and a variety of natural curiosities.

The British museum in London is a large, beautiful, and magnificent building, the noblest cabinet of curiosities in the world. See the article London, n° 155.

MUSGRAVE (Dr William), a learned physician and antiquary, was born at Charlton-Musgrave in Somersetshire, about the year 1657; and studied at New-college, Oxford. Having distinguished himself by his knowledge in his profession, and his skill in natural philosophy, he was elected fellow of the Royal Society; and being made secretary in 1684, he continued the Philosophical Transactions from n° 167 to n° 178 inclusive. After having taken his degrees in physic, and being admitted a fellow of the college of physicians, he went and settled at Exeter, where he practised physic with great reputation and success. Being a man of extensive learning, he composed, at his leisure-hours, several curious and valuable works; as, 1. *De arthritide anomala sive interna dissertatio*. 2. *De arthritide symptomatica dissertatio*. 3. *Julii Vitalis epitaphium, cum commentario*. 4. *De legionibus epistola*. 5. *De aquilis Romanis epistola*. 6. *Inscriptio Terraconensis, cum commentario*. 7. *Geta Britannicus*, &c.— 8. *Belgium Britannicum*. This learned physician died in 1721.

MUSHROOM, in botany. See Agaricus and Lyncurius.

To try the quality of mushrooms:—Take an onion, and strip the outer skin, and boil it with your mushrooms: if the onion become blue or black, there are certainly dangerous ones amongst them; if it remain white, they are good.

MUSIC;

M U S I C;

1 Definition. THE art of combining ſounds in a manner agreeable to the ear. This combination may be either ſimultaneous or ſucceſſive: in the firſt caſe, it conſtitutes harmony; in the laſt, melody. But though the ſame ſounds, or intervals of ſound, which give pleaſure when heard in ſucceſſion, will not always produce the ſame effect in harmony; yet the principles which conſtitute the ſimpler and more perfect kinds of harmony, are almoſt, if not entirely, the ſame with thoſe of melody. By *perfect harmony*, we do not here mean that plenitude, thoſe complex modifications of harmonic ſound, which are admired in practice; but that harmony which is called *perfect* by theoricians and artiſts; that harmony which reſults from the coaleſcence of ſimultaneous ſounds produced by vibrations in the proportions of thirds, fifths, and octaves, or their duplicates.

The principles upon which theſe various combinations of ſound are founded, and by which they are regulated, conſtitute a ſcience, which is not only extenſive but profound, when we would inveſtigate the principles from whence theſe happy modifications of ſound reſult, and by which they are determined; or when we would explore the ſenſations, whether mental or corporeal, with which they affect us. The ancient definitions of muſic are not proportioned in their extent to our preſent ideas of that art; but M. Rouſſeau betrays a temerity highly inconſiſtent with the philoſophical character, when from thence he infers, that their ideas were vague and undetermined. Every ſoul ſuſceptible of refinement and delicacy in taſte or ſentiment, muſt be conſcious that there is a muſic in action as well as in ſound; and that the ideas of beauty and decorum, of harmony and ſymmetry, are, if we may uſe the expreſſion, equally conſtituent of viſible as of audible muſic. Thoſe illuſtrious minds, whoſe comprehenſive proſpects in every ſcience where taſte and propriety prevail took in nature at a ſingle glance, would behold with contempt and ridicule thoſe narrow and microſcopic views of which alone their ſucceſſors in philoſophy have diſcovered themſelves capacious. With theſe definitions, however, we are leſs concerned, as they bear no proportion to the ideas which are now entertained of muſic. Nor can we follow M. Rouſſeau, from whatever venerable ſources his authority may be derived, in adopting his Egyptian etymology for the word *muſic*. The eſtabliſhed derivation from *Muſa* could only be queſtioned by a paradoxical genius. That muſic had been practiſed in Egypt before it was known as an art in Greece, is indeed a fact which cannot be queſtioned; but it does not thence follow that the Greeks had borrowed the name as well as the art from Egypt. If the art of muſic be ſo natural to man that vocal melody is practiſed wherever articulate ſounds are uſed, there can be little reaſon for deducing the idea of muſic from the whiſtling of winds through the reeds that grew on the river Nile. And indeed, when we reflect with how eaſy a tranſition we may paſs from the accents of ſpeaking to diatonic ſounds; when we obſerve how early children adapt the language of their amuſements to meaſure and melody, however rude; when we conſider how early and univerſally theſe practices take place—there is no avoiding the concluſion, that the idea of muſic is connatural to man, and implied in the original principles of his conſtitution. We have already ſaid, that the principles on which it is founded, and the rules by which it is conducted, conſtitute a ſcience. The ſame maxims when applied to practice form an art: hence its firſt and moſt capital diviſion is into *ſpeculative* and *practical* muſic.

Speculative muſic is, if we may be permitted to uſe the expreſſion, the knowledge of the nature and uſe of thoſe materials which compoſe it; or, in other words, of all the different relations between the high and low, between the harſh and the ſweet, between the ſwift and the ſlow, between the ſtrong and the weak, of which ſounds are ſuſceptible: relations which, comprehending all the poſſible combinations of muſic and ſounds, ſeem likewiſe to comprehend all the cauſes of the impreſſions which their ſucceſſion can make upon the ear and upon the ſoul.

Practical muſic is the art of applying and reducing to practice thoſe principles which reſult from the theory of agreeable ſounds, whether ſimultaneous or ſucceſſive; or, in other words, to conduct and arrange ſounds according to the proportions reſulting from conſonance, from duration and ſucceſſion, in ſuch a manner as to produce upon the ear the effect which the compoſer intends. This is the art which we call *compoſition* *. With reſpect to the actual production of ſounds by voices or inſtruments, which is called *execution*, this department is merely mechanical and operative: which, only preſuppoſing the powers of ſounding the intervals true, of exactly proportioning their degrees of duration, of elevating or depreſſing ſounds according to thoſe gradations which are preſcribed by the tone, and to the value required by the time, demands no other knowledge but a familiar acquaintance with the characters uſed in muſic, and a habit of expreſſing them with promptitude and facility.

* See *Compoſition*.

Speculative muſic is likewiſe divided into two departments; *viz.* the knowledge of the proportions of ſounds or their intervals, and that of their relative durations; that is to ſay, of meaſure and of time.

The firſt is what among the ancients ſeems to have been called *harmonical* muſic. It ſhows in what the nature of air or melody conſiſts; and diſcovers what is conſonant or diſcordant, agreeable or diſagreeable, in the modulation. It diſcovers, in a word, the effects which ſounds produce on the ear by their nature, by their force, and by their intervals; which is equally applicable to their conſonance and their ſucceſſion.

The ſecond has been called *rhythmical*, becauſe it treats of ſounds with regard to their time and quantity. It contains the explication of their continuance, of their proportions, of their meaſures whether long or

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ſhort, quick or ſlow, of the different modes of time and the parts into which they are divided, that to theſe the ſucceſſion of ſounds may be conformed.

Practical muſic is likewiſe divided into two departments, which correſpond to the two preceding.

That which anſwers to *harmonical* muſic, and which the ancients called *melopée*, teaches the rules for combining and varying the intervals, whether conſonant or diſſonant, in an agreeable and harmonious manner.

The ſecond, which anſwers to the *rhythmical* muſic, and which they called *rhythmopée*, contains the rules for applying the different modes of time, for underſtanding the feet by which verſes were ſcanned, and the diverſities of meaſure; in a word, for the practice of the rhythmus.

Muſic is at preſent divided more ſimply into *melody* and *harmony;* for ſince the introduction of *harmony* the proportion between the length and ſhortneſs of ſounds, or even that between the diſtance of returning cadences, are of leſs conſequence amongſt us. For it often happens in modern languages, that the verſes aſſume their meaſures from the muſical air, and almoſt entirely loſe the ſmall ſhare of proportion and quantity which in themſelves they poſſeſs.

By melody the ſucceſſions of ſound are regulated in ſuch a manner as to produce pleaſing airs. See MELODY.

Harmony conſiſts in uniting to each of the ſounds, in a regular ſucceſſion, two or more different ſounds, which ſimultaneouſly ſtriking the ear ſoothe it by their concurrence. See HARMONY.

Muſic, according to Rouſſeau, may be, and perhaps likewiſe ought to be, divided into the *phyſical* and the *imitative.* The firſt is limited to the mere mechaniſm of ſounds, and reaches no farther than the external ſenſes, without carrying its impreſſions to the heart, and can produce nothing but corporeal ſenſations more or leſs agreeable. Such is the muſic of ſongs, of hymns, of all the airs which only conſiſt in combinations of melodious ſounds, and in general all muſic which is merely harmonious.

It may, however, be queſtioned, whether every ſound, even to the moſt ſimple, is not either by nature or by early and confirmed aſſociation, *imitative.* If we may truſt our own feelings, there is no ſuch thing in nature as muſic which gives mechanical pleaſure alone. For if ſo, it muſt give ſuch pleaſure as we receive from taſtes, from odours, or from other grateful titillations; but we abſolutely deny that there are any muſical ſenſations or pleaſures in the ſmalleſt degree analogous to theſe. Let any piece of muſic be reſolved into its elementary parts and their proportions, it will then eaſily appear from this analyſis, that ſenſe is no more than the vehicle of ſuch perceptions, and that mind alone can be ſuſceptible of them. It may indeed happen, from the number of the performers and the complication of the harmony, that meaning and ſentiment may be loſt in the multiplicity of ſounds; but this, though it may be harmony, loſes the name of *muſic.*

The ſecond department of this diviſion, by lively and accentuated inflections, and by ſounds which may be ſaid to ſpeak, expreſſes all the paſſions, paints every poſſible picture, reflects every object, ſubjects the whole of nature to its ſkilful imitations, and impreſſes even on the heart and ſoul of man ſentiments proper to affect them in the moſt ſenſible manner. This, continues he, which is the genuine lyric and theatrical muſic, was what gave double charms and energy to ancient poetry; this is what, in our days, we exert ourſelves in applying to the drama, and what our ſingers execute on the ſtage. It is in this muſic alone, and not in harmonics or the reſonance of nature, that we muſt expect to find accounts of thoſe prodigious effects which it formerly produced.

But, with M. Rouſſeau's permiſſion, all muſic which is not in ſome degree characteriſed by theſe pathetic and imitative powers, deſerves no better name than that of a *muſical jargon*, and can only be effectuated by ſuch a complication and intricacy of harmony, as may confound, but cannot entertain the audience. This character, therefore, ought to be added as eſſential to the definition of muſic; and it muſt be attributed to our neglect of this alone, whilſt our whole attention is beſtowed on harmony and execution, that the beſt performances of our artiſts and compoſers are heard with liſtleſs indifference and oſcitation, nor ever can conciliate any admirers, but ſuch as are induced, by pedantry and affectation, to pretend what they do not feel. Still may the curſe of indifference and inattention purſue and harrow up the ſouls of every compoſer or performer, who pretends to regale our ears with this muſical legerdemain, till the grin of ſcorn, or the hiſs of infamy, teach them to correct this depravity of taſte, and entertain us with the voice of nature!

Whilſt moral effects are ſought in the natural effects of ſound alone, the ſcrutiny will be vain, and diſputes will be maintained without being underſtood: but ſounds, as repreſentatives of objects, whether by nature or aſſociation, introduce new ſcenes to the fancy and new feelings to the heart; not from their mechanical powers, but from the connection eſtabliſhed by the Author of our frame between ſounds and the objects which either by natural reſemblance or unavoidable aſſociation they are made to repreſent.

It would ſeem that muſic was one of thoſe arts which were firſt diſcovered: and that vocal was prior to inſtrumental muſic, if in the earlieſt ages there was any muſic which could be ſaid to be purely inſtrumental. For it is more than probable, that muſic was originally formed to be the vehicle of poetry; and of conſequence, though the voice might be ſupported and accompanied by inſtruments, yet muſic was never intended for inſtruments alone.

We are told by ancient authors, that all the laws, whether human or divine, exhortations to virtue, the knowledge of the characters and actions of gods and heroes, the lives and atchievements of illuſtrious men, were written in verſe, and ſung publicly by a quire to the ſound of inſtruments; and it appears from the Scriptures, that ſuch from the earlieſt times was the cuſtom among the Iſraelites. Nor was it poſſible to find means more efficacious for impreſſing on the mind of man the principles of morals, and inſpiring the love of virtue. Perhaps, however, this was not the reſult of a premeditated plan; but inſpired by ſublime ſentiments and elevation of thought, which in accents that were ſuited and proportioned to their celeſtial nature endeavoured to find a language worthy of themſelves and expreſſive of their grandeur.

It merits attention, that the ancients were duly ſen-

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fible of the value and importance of this divine art, not only as a fymbol of that univerfal order and fymmetry which prevails through the whole frame of material and intelligent nature, but as productive of the moft momentous effects both in moral and political life. Plato and Ariftotle, who difagreed almoft in every other maxim of politics, are unanimous in their approbation of mufic, as an efficacious inftrument in the formation of the public character and in conducting the ftate; and it was the general opinion, that whilft the gymnaftic exercifes rendered the conftitution robuft and hardy, mufic humanifed the character, and foftened thofe habits of roughnefs and ferocity by which men might otherwife have degenerated into favages. The gradations by which voices were exerted and tuned, by which the invention of one inftrument fucceeded to another, or by which the principles of mufic were collected and methodifed in fuch a manner as to give it the form of an art and the dignity of a fcience, are topics fo fruitful of conjecture and fo void of certainty, that we muft leave them to employ minds more fpeculative and inventions more prolific than ours, or transfer them to the *Hiftory* of Mufic as a more proper place for fuch difquifitions. For the amufement of the curious, Rouffeau in his *Mufical Dictionary*, Plates C and N, has tranfcribed fome fragments of Grecian, Perfian, American, Chinefe, and Swifs mufic, with which performers may entertain themfelves at leifure. When they have tried the pieces, it is imagined they will be lefs fanguinely fond than that author of afcribing the power of mufic to its affinity with the national accents where it is compofed. This may doubtlefs have its influence; but there are other caufes more permanent and lefs arbitrary to which it owes its moft powerful and univerfal charms.

The mufic now moft generally celebrated and practifed is that of the Italians, or their fuccefsful imitatators. The Englifh, from the invafion of the Saxons, to that more late though lucid era in which they imbibed the art and copied the manner of the Italians, had a mufic which neither pleafed the foul nor charmed the ear. The primitive mufic of the French deferves no higher panegyric. Of all the barbarous nations, the Scots and Irifh feem to have poffeffed the moft affecting original mufic. The firft confifts of a melody characterifed by tendernefs: It melts the foul to a pleafing penfive languor. The other is the native expreffion of grief and melancholy. Taffoni informs us, that in his time a prince from Scotland had imported into Italy a lamentable kind of mufic from his own country; and that he himfelf had compofed pieces in the fame fpirit. From this expreffive though laconic defcription, we learn, that the character of our national mufic was even then eftablifhed; yet fo grofs is our ignorance and credulity, that we afcribe the beft and moft impaffioned airs which are extant among us to David Rizzio; as if an Italian Lutanift, who had lived fo fhort a time in Scotland, could at once, as it were by infpiration, have imbibed a fpirit and compofed in a manner fo different from his own. It is yet more furprifing that Geminiani fhould have entertained and publifhed the fame prejudice, upon the miferable authority of popular tradition alone; for the fact is authenticated by no better credentials. The primitive mufic of the Scots may be divided into the *martial*, the *paftoral*, and the *feftive*. The *firft* confifts either in marches, which were played before the chieftains, in imitation of the battles which they fought, or in lamentations for the cataftrophes of war and the extinction of families. Thefe wild effufions of natural melody preferve feveral of the rules prefcribed for compofition. The ftrains, though rude and untutored, are frequently terrible or mournful in a very high degree. The port or march is fometimes in common, fometimes in treble time; regular in its meafures, and exact in the diftance between its returning cadences; moft frequently, though not always, loud and brifk. The *pibroch*, or imitation of battles, is wild, and abrupt in its tranfitions from interval to interval and from key to key; various and defultory in its movements; frequently irregular in the return of its cadences; and in fhort, through the whole, feems infpired with fuch fury and enthufiafm, that the hearer is irrefiftibly infected with all the rage of precipitate courage, notwithftanding the rudenefs of the accents by which it is kindled. To this the *paftoral* forms a ftriking contraft. Its accents are plaintive, yet foothing; its harmony generally flat; its modulations natural and agreeable; its rhythmus fimple and regular; its returning cadences at equal diftance; its tranfitions from one concinnous interval to another, at leaft for the moft part; its movements flow, and may be either in common or treble time. It fcarcely admits of any other harmony than that of a fimple bafs. A greater number of parts would cover the air and deftroy the melody. To this we fhall add what has been faid upon the fame fubject by Dr Franklin. Writing to Lord K———, he proceeds thus:

"Give me leave, on this occafion, to extend a little the fenfe of your pofition, 'That melody and harmony are feparately agreeable, and in union delightful;' and to give it as my opinion, that the reafon why the Scotch tunes have lived fo long, and will probably live for ever (if they efcape being ftifled in modern affected ornament), is merely this, that they are really compofitions of melody and harmony united, or rather that their melody is harmony. I mean, the fimple tunes fung by a fingle voice. As this will appear paradoxical, I muft explain my meaning. In common acceptation, indeed, only an agreeable *fucceffion* of founds is called *melody;* and only the *coexiftence* of agreeable founds, *harmony*. But fince the memory is capable of retaining for fome moments a perfect idea of the pitch of a paft found, fo as to compare it with the pitch of a fucceeding found, and judge truly of their agreement or difagreement, there may and does arife from thence a fenfe of harmony between the prefent and paft founds, equally pleafing with that between two prefent founds. Now the conftruction of the old Scotch tunes is this, that almoft every fucceeding emphatical note is a third, a fifth, an octave, or in fhort fome note that is in concord with the preceding note. Thirds are chiefly ufed, which are very pleafing concords. I ufe the word *emphatical*, to diftinguifh thofe notes which have a ftrefs laid on them in finging the tune, from the lighter connecting notes that ferve merely, like grammar-articles in common fpeech, to tack the whole together.

"That we have a moft perfect idea of a found juft paft, I might appeal to all acquainted with mufic,

who know how eaſy it is to repeat a ſound in the ſame pitch with one juſt heard. In tuning an inſtrument, a good ear can as eaſily determine that two ſtrings are in uniſon by ſounding them ſeparately, as by ſounding them together; their diſagreement is alſo as eaſily, I believe I may ſay more eaſily and better diſtinguiſhed when ſounded ſeparately; for when ſounded together, though you know by the beating that one is higher than the other, you cannot tell which it is. I have aſcribed to memory the ability of comparing the pitch of a preſent tone with that of one paſt. But if there ſhould be, as poſſibly there may be, ſomething in the ear ſimilar to what we find in the eye, that ability would not be entirely owing to memory. Poſſibly the vibrations given to the auditory nerves by a particular ſound may actually continue for ſome time after the cauſe of theſe vibrations is paſt, and the agreement or diſagreement of a ſubſequent ſound become by compariſon with them more diſcernible. For the impreſſion made on the viſual nerves by a luminous object will continue for 20 or 30 ſeconds."

After ſome experiments to prove the permanency of viſible impreſſions, he continues thus:

"Farther, when we conſider by whom theſe ancient tunes were compoſed, and how they were firſt performed, we ſhall ſee that ſuch harmonical ſucceſſions of ſounds was natural and even neceſſary in their conſtruction. They were compoſed by the minſtrels of thoſe days, to be played on the harp accompanied by the voice. The harp was ſtrung with wire, which gives a ſound of long continuance; and had no contrivance like that of the modern harpſichord, by which the ſound of the preceding note can be ſtopt the moment a ſucceeding note begins. To avoid actual diſcord, it was therefore neceſſary that the ſucceeding emphatic note ſhould be a cord with the preceding, as their ſounds muſt exiſt at the ſame time. Hence aroſe that beauty in thoſe tunes that has ſo long pleaſed, and will pleaſe for ever, though men ſcarce know why. That they were originally compoſed for the harp, and of the moſt ſimple kind, I mean a harp without any half-notes but thoſe in the natural ſcale, and with no more than two octaves of ſtrings, from C to C, I conjecture from another circumſtance; which is, that not one of theſe tunes, really ancient, has a ſingle artificial half-note in it; and that in tunes where it is moſt convenient for the voice to uſe the middle notes of the harp, and place the key in F, there the B, which if uſed ſhould be a B flat, is always omitted, by paſſing over it with a third. The connoiſſeurs in modern muſic will ſay I have no taſte: but I cannot help adding, that I believe our anceſtors, in having a good ſong, diſtinctly articulated, ſung to one of thoſe tunes, and accompanied by the harp, felt more real pleaſure than is communicated by the generality of modern operas, excluſive of that ariſing from the ſcenery and dancing. Moſt tunes of late compoſition, not having this natural harmony united with their melody, have recourſe to the artificial harmony of a baſs, and other accompanying parts. This ſupport, in my opinion, the old tunes do not need, and are rather confuſed than aided by it. Whoever has heard *James Oſwald* play them on his violincello, will be leſs inclined to diſpute this with me. I have more than once ſeen tears of pleaſure in the eyes of his auditors: and yet I think, even *his* playing thoſe tunes would pleaſe more if he gave them leſs modern ornament."

As theſe obſervations are for the moſt part true and always ingenious, we need no other apology for quoting them at length. It is only proper to remark, that the tranſition in Scots muſic by conſonant intervals, does not ſeem, as Dr Franklin imagines, to ariſe from the nature of the inſtruments upon which they played. It is more than probable, that the ancient Britiſh harp was not ſtrung with wire, but with the ſame materials as the Welſh harps at preſent. Theſe ſtrings have not the ſame permanency of tone as metal; ſo that the ſound of a preceding emphatic note muſt have expired before the ſubſequent accented note could be introduced. Beſides, they who are acquainted with the manœuvre of the Iriſh harp, know well that there is a method of diſcontinuing ſounds no leſs eaſy and effectual than upon the harpſichord. When the performer finds it proper to interrupt a note, he has no more to do but return his finger gently upon the ſtring immediately ſtruck, which effectually ſtops its vibration.

That ſpecies of Scots muſic which we have diſtinguiſhed by the name of *feſtive* ſeems now limited to reels and country-dances. Theſe may be either in common or treble time. They moſt frequently conſiſt of two ſtrains: each of theſe contains eight or twelve bars. They are truly rhythmical; but the mirth which they excite ſeems rather to be inſpired by the vivacity of the movement, than either by the force or variety of the melody. They have a manœuvre and expreſſion peculiar to themſelves, which it is impoſſible to deſcribe, and which can only be exhibited by good performers.

Thus far we have purſued the general idea of muſic. We ſhall, after the hiſtory, give a more particular detail of the ſcience from Monſieur D'Alembert.

HISTORY OF MUSIC.

2 No accurate accounts of the ſtate of muſic in the earlieſt ages of the world.

MUSIC is capable of a variety ſo infinite, ſo greatly does the moſt ſimple differ from the moſt complex, and ſo multiplied are the degrees between theſe two extremes, that in no age could the incidents reſpecting that faſcinating art have been few or unintereſting. But, that accounts of theſe incidents ſhould have been handed down to us, ſcanty and imperfect, is no matter of ſurpriſe, when we recollect that the hiſtory of muſic is the hiſtory only of ſounds, of which writing is a very inadequate medium; and that men would long employ themſelves in the pleaſing exerciſe of cultivating muſic before they poſſeſſed either the ability or the inclination to record their exertions.

No accurate traces, therefore, of the actual ſtate of muſic, in the earlier ages of the world, can be diſcerned. Our ideas on the ſubject have no foundation firmer than conjecture and analogy.

It is probable, that among all barbarous nations ſome degree of ſimilarity is diſcernible in the ſtyle of their

their mufic. Neither will much difference appear during the firft dawnings of civilization. But in the more advanced periods of fociety, when the powers of the human mind are permitted without obftacle to exert their native activity and tendency to invention, and are at the fame time affected by the infinite variety of circumftances and fituations which before had no exiftence, and which in one cafe accelerate, and in another retard; then that fimilarity, once fo diftinguifhable, gives place to the endlefs diverfity of which the fubject is capable.

3
Mufic not he invention of any ne man.

The practice of mufic being univerfal in all ages and all nations, it would be abfurd to attribute the invention of the art to any one man. It muft have fuffered a regular progreffion, through infancy, childhood, and youth, before it could arrive at maturity. The firft attempts muft have been rude and artlefs; perhaps the firft flute was a reed of the lake.

No nation has been able to produce proofs of antiquity fo indifputable as the Egyptians; it would be vain, therefore, to attempt tracing mufic higher than the hiftory of Egypt.

4
Egyptian mufic.

By comparing the accounts of Diodorus Siculus and of Plato, there is reafon to fuppofe, that in very ancient times the ftudy of mufic in Egypt was confined to the priefthood, who ufed it only on religious and folemn occafions; that, as well as fculpture, it was circumfcribed by law; that it was efteemed facred, and forbidden to be employed on light or common occafions; and that innovation in it was prohibited: but what the ftyle or relative excellence of this very ancient mufic was, there are no traces by which we can form an accurate judgment. After the reigns of the Pharaohs, the Egyptians fell by turns under the dominion of the Ethiopians, the Perfians, the Greeks, and the Romans. By fuch revolutions, the manners and amufements of the people, as well as their form of government, muft have been changed. In the age of the Ptolemies, the mufical games and contefts inftituted by thofe monarchs were of Greek origin, and the muficians who performed were chiefly Greek.

The moft ancient monuments of human art and induftry, at prefent extant at Rome, are the obelifks brought thither from Egypt, two of which are faid to have been erected by Sefoftris at Heliopolis, about 400 years before the fiege of Troy. Thefe were by the order of Auguftus brought to Rome after the conqueft of Egypt. One of them called *guglia rotta*, or the broken pillar, which during the facking of the city in 1527 was thrown down and broken, ftill lies in the Campus Martius. On it is feen the figure of

5
n Egypan mufical ftrument.

a mufical inftrument of two ftrings, and with a neck. It refembles much the calafcione ftill ufed in the kingdom of Naples.

This curious relict of antiquity is mentioned, becaufe it affords better evidence than, on the fubject of ancient mufic, is ufually to be met with, that the Egyptians, at fo very early a period of their hiftory, had advanced to a confiderable degree of excellence in the cultivation of the arts. By means of its neck, this inftrument was capable, with only two ftrings, of producing a great number of notes. Thefe two ftrings, if tuned fourths to each other, would furnifh that feries of founds called by the ancients *heptachord*, which confifts of a conjunct tetrachord as B, C, D, E; E, F, G, A; if tuned fifths, they would produce an octave, or two disjunct tetrachords. The calafcione is tuned in this laft manner. The annals of no nation other than Egypt, for many ages after the period of the obelifk at Heliopolis, exhibit the veftige of any contrivance to fhorten ftrings during performance by a neck or finger-board. Father Montfaucon obferves, that after examining 500 ancient lyres, harps, and citharas, he could difcover no fuch thing.

Egypt indeed feems to have been the fource of human intelligence, and the favourite refidence of genius and invention. From that celebrated country did the Greeks derive their knowledge of the firft elements of thofe arts and fciences in which they afterwards fo eminently excelled. From Greece again did the Romans borrow their attainments in the fame purfuits. And from the records of thofe different nations have the moderns been enabled to accomplifh an improvement fo wonderful in literature.

6
The Egyptian Hermes the inventor of the lyre.

The Hermes or Mercury of the Egyptians, firnamed *Trifmegiftus*, or *thrice illuftrious*, who was, according to Sir Ifaac Newton, the fecretary of Ofiris, is celebrated as the inventor of mufic. It has already been obferved, that no one perfon ought ftrictly to be called the inventor of an art which feems to be natural to, and coeval with, the human fpecies; but the Egyptian Mercury is without doubt intitled to the praife of having made ftriking improvements in mufic, as well as of having advanced in various refpects the civilization of the people, whofe government was chiefly committed to his charge. The account given by Apollodorus of the manner in which he accidentally invented the lyre, is at once entertaining and probable. "The Nile (fays Apollodorus), after having overflowed the whole country of Egypt, when it returned within its natural bounds, left on the fhore a great number of dead animals of various kinds, and among the reft a tortoife; the flefh of which being dried and wafted by the fun, nothing remained within the fhell but nerves and cartilages, and thefe being braced and contracted by the drying heat became fonorous. Mercury, walking along the banks of the Nile, happened to ftrike his foot againft this fhell; and was fo pleafed with the found produced, that the idea of a lyre ftarted into his imagination. He conftructed the inftrument in the form of a tortoife, and ftrung it with the dried finews of dead animals."

How beautiful to conceive the energetic powers of the human mind in the early ages of the world, exploring the yet undifcovered capabilities of nature, and directed to the inexhauftible ftore by the finger of God, in the form of accident!

7
The fingle flute of the Egyptians.

The monaulos, or fingle flute, called by the Egyptians photinx, was probably one of the moft ancient inftruments ufed either by them or any other nation. From various remains of ancient fculpture, it appears to have been fhaped like a bull's horn, and was at firft, it may be fuppofed, no other than the horn itfelf.—Before the invention of flutes, as no other inftrument except thofe of percuffion were known, mufic muft have been little more than metrical. When the art of refining and lengthening founds was firft difcovered,

the power of muſic over mankind, from the agreeable ſurpriſe occaſioned by ſoft and extended notes, was probably irreſiſtible. At a time when all the reſt of the world was involved in ſavage ignorance, the Egyptians were poſſeſſed of muſical inſtruments capable of much variety and expreſſion —Of this the aſtoniſhing remains of the city Thebes ſtill ſubſiſting afford ample evidence. In a letter from Mr Bruce, ingroſſed in Dr Burney's Hiſtory of Muſic, there is given a particular deſcription of the Theban harp, an inſtrument of extenſive compaſs, and exquiſite elegance of form. It is accompanied with a drawing taken from the ruins of an ancient ſepulchre at Thebes, ſuppoſed by Mr Bruce to be that of the father of Seſoſtris.

8
The Theban harp of Egypt.

On the ſubject of this harp, Mr Bruce makes the following ſtriking obſervation. "It overturns all the accounts of the earlieſt ſtate of ancient muſic and inſtruments in Egypt, and is altogether, in its form, ornaments, and compaſs, an inconteſtable proof, ſtronger than a thouſand Greek quotations, that geometry, drawing, mechanics, and muſic, were at the greateſt perfection when this harp was made; and that what we think in Egypt was the invention of arts was only the beginning of the æra of their reſtoration."

Indeed, when the beauty and powers of this harp, along with the very great antiquity of the painting which repreſents it, are conſidered, ſuch an opinion as that which Mr Bruce hints at, does not ſeem to be devoid of probability.

It cannot be doubted that during the reigns of the Ptolemies, who were voluptuous princes, muſic muſt have been much cultivated and encouraged. The father of Cleopatra, who was the laſt of that race of kings, derived his title of auletes, or flute-player, from his exceſſive attachment to the flute. Like Nero, he uſed to array himſelf in the dreſs of a tibicen, and exhibit his performance in the public muſical conteſts.

Some authors, particularly Am. Marcellinus and M. Pau, refuſe to the Egyptians, at any period of their hiſtory, any muſical genius, or any excellence in the art; but the arguments uſed to ſupport this opinion ſeem to be inconcluſive, and the evidences of the oppoſite deciſion appear to be inconteſtable.

9
Hebrew muſic

The ſacred Scriptures afford almoſt the only materials from which any knowledge of Hebrew muſic can be drawn. In the rapid ſketch, therefore, of ancient muſic which we mean to exhibit, a very few obſervations are all which can properly be given to that department of our ſubject.

Moſes, who led the Iſraelites out of Egypt, was educated by Pharaoh's daughter in all the literature and elegant arts cultivated in that country. It is probable, therefore, that the taſte and ſtyle of Egyptian muſic would be infuſed in ſome degree into that of the Hebrews. Muſic appears to have been interwoven through the whole tiſſue of religious ceremony in Paleſtine. The prieſthood ſeem to have been muſicians hereditarily and by office. The prophets appear to have accompanied their inſpired effuſions with muſic; and every prophet, like the preſent improviſatori of Italy, ſeems to have been accompanied by a muſical inſtrument.

Muſic, vocal and inſtrumental, conſtituted a great part of the funeral ceremonies of the Jews. The pomp and expence uſed on theſe occaſions advanced by degrees to an exceſſive extent. The number of flute-players in the proceſſions amounted ſometimes to ſeveral hundreds, and the attendance of the gueſts continued frequently for 30 days†.

† *Joſephus*, L. 3. c. 9.

The Hebrew language abounds with conſonants, and has ſo few vowels, that in the original alphabet they had no characters. It muſt, therefore, have been harſh and unfavourable to muſic. Their inſtruments of muſic were chiefly thoſe of percuſſion; ſo that, both on account of the language and the inſtruments, the muſic muſt have been coarſe and noiſy. The vaſt numbers of performers too, whom it was the taſte of the Hebrews to collect together, could with ſuch language and ſuch inſtruments produce nothing but clamour and jargon. According to Joſephus, there were 200,000 muſicians at the dedication of Solomon's temple. Such are the circumſtances from which only an idea of Hebrew muſic can be formed; for the Jews neither ancient nor modern have ever had any characters peculiar to muſic; and the melodies uſed in their religious ceremonies have at all times been entirely traditional

10
coarſe and noiſy.

11
Grecian muſic.

Cadmus, wish the Phœnician colony which he led into Greece, imported at the ſame time various arts into that country. By the aſſiſtance of his Phœnician artificers, that chief diſcovered gold in Thrace and copper at Thebes. At Thebes that metal is ſtill termed *cadmia*. Of theſe materials, and of iron, they formed to themſelves armour and inſtruments of war. Theſe they ſtruck againſt each other during their dances at ſacrifices, by which they firſt obtained the idea of muſic. Such is the account given of the origin of that ſpecies of muſic in Greece produced by inſtruments of percuſſion. The invention of wind inſtruments in Greece is attributed to Minerva; and to the Grecian Mercury is aſſigned, by the poets and hiſtorians of that country, the honour of many diſcoveries probably due to the Egyptian Hermes, particularly the invention of ſtringed inſtruments. The lyre of the Egyptian Mercury had only three ſtrings; that of the Grecian ſeven: the laſt was perhaps no more than an improvement on the other. When the Greeks deified a prince or hero of their own country, they uſually aſſigned him an Egyptian name, and with the name beſtowed on their new divinity all the actions, attributes, and rites of the original.

The Grecian lyre, although ſaid to have been invented by Mercury, was cultivated principally by Apollo, who firſt played upon it with method, and accompanied it with the voice. The celebrated conteſt between him and Marſyas is mentioned by various authors; in which, by conjoining the voice with his lyre (a combination never before attempted), his muſic was declared ſuperior to the flute of Marſyas. The progreſs of the lyre, according to Diodorus Siculus, is the following. "The muſes added to the Grecian lyre the ſtring called *meſe*; Linus that of lichanos; and Orpheus and Thamyras thoſe ſtrings which are named hypate and parhypate." It has been already mentioned, that the lyre invented by the Egyptian Mercury had but three ſtrings; by putting theſe circumſtances together, we may perhaps acquire ſome knowledge of the progreſs of muſic, or at leaſt of the extenſion of its ſcale in the higheſt antiquity. *Meſe*, in the Greek muſic, is the fourth ſound of the ſecond tetrachord

12
Progreſs of the Grecian lyre.

tetrachord of the great ſyſtem and firſt tetrachord invented by the ancients, anſwering to our A, on the fifth line in the baſe. If this ſound then was added to the former three, it proves that the moſt ancient tetrachord was that from E in the baſe to A ; and that the three original ſtrings in the Mercurian and Apollonian lyre were tuned E, F, G, which the Greeks call *hypate meſon*, *parhypate meſon*, and *meſon diatonos* ; the addition, therefore, of *meſe* to theſe completed the firſt and moſt ancient tetrachord E, F, G, A. The ſtring lichanos again being added to theſe, and anſwering to our D on the third line in the baſe, extended the compaſs downwards, and gave the ancient lyre a regular ſeries of five ſounds. The two ſtrings hypate and parhypate, correſponding with our B and C in the baſe, completed the heptachord or ſeven ſounds b, c, d, e, f, g, a ; a compaſs which received no addition till after the days of Pindar.

It might perhaps be expected, that in a hiſtory of Greek muſic ſomething ought to be ſaid concerning the muſes Apollo, Bacchus, and the other gods and demi-gods, who in the mythology of that country appear to have promoted and improved the art. But ſuch a diſcuſſion would be too diffuſive, and involve too much foreign matter for the plan we have choſen to adopt. We cannot avoid, howev..., making a few obſervations on the poems of Homer, in ſo far as connected with our ſubject. It has been imagined, with much appearance of probability, that the occupation of the firſt poets and muſicians of Greece reſembled that of the Celtic and German bards and the ſcalds of Iceland and Scandinavia. They ſung their poems in the ſtreets of cities and in the palaces of princes. They were treated with high reſpect, and regarded as inſpired perſons. Such was the employment of Homer. His poems, ſo juſtly celebrated, exhibit the moſt authentic picture that can be found in the annals of antiquity, although perhaps ſomewhat highly coloured, of the times of which he wrote and in which he lived. Muſic is always named throughout the Iliad and Odyſſey with rapture ; but as in theſe poems no mention is made of inſtrumental muſic unaccompanied with poetry and ſinging, a conſiderable ſhare no doubt of the poet's praiſes is to be attributed to the poetry. The inſtruments moſt frequently named are the lyre, the flute, and the ſyrinx. The trumpet appears not to have been known at the ſiege of Troy, although it had come to be in uſe in the days of Homer himſelf. From the time of Homer till that of Sappho, there is almoſt a total blank in literature. Only a few fragments remain of the works of thoſe poets and muſicians whoſe names are preſerved as having flouriſhed between thoſe periods (†). During the century which elapſed between the days of Sappho and thoſe of Anacreon, no literary productions are preſerved entire.—From Anacreon to Pindar there is another chaſm of near a century. Subſequent to this time, the works ſtill extant of the three great tragic poets, Æſchylus, Sophocles, and Euripides, together with thoſe of Plato, Ariſtotle, Ariſtoxenus, Euclid, Theocritus, Callimachus, Polybius, and many others, produced all within a ſpace leſs than 300 years, diſtinguiſh this illuſtrious and uncommon period as that in which the whole powers of genius ſeem to have been exerted to illuminate and inſtruct mankind in future ages. Then it was that eloquence, poetry, *muſic*, architecture, hiſtory, painting, ſculpture, like the ſpontaneous bloſſoms of nature, flouriſhed without the appearance of labour or of art.

13 cupation the firſt ets and ficians Greece.

The poets, as well epic as lyric and elegiac, were all likewiſe muſicians ; ſo ſtrictly connected were muſic and poetry for many ages. It would afford amuſement to collect the biographical anecdotes of theſe favourites of genius, and to aſſign to each the reſpective improvements made by him in muſic and poetry ; but our limits do not admit of ſo extenſive a diſquiſition ; for which, therefore, reference muſt be made to the editors and commentators of theſe authors, and to the voluminous hiſtories of muſic lately publiſhed.

14 The invention of muſical characters.

The invention of notation and muſical characters marked a diſtinguiſhed æra in the progreſs of muſic. There are a diverſity of accounts reſpecting the perſon to whom the honour of that invention is due; but the evidences ſeem to preponderate in favour of Terpander, a celebrated poet and muſician, to whoſe genius muſic is much indebted. He flouriſhed about the 27th Olympiad, or 671 years before Chriſt.

Before that valuable diſcovery, muſic being entirely traditional, muſt have depended much on the memory and taſte of the performer.

There is an incident mentioned in the accounts handed down to us of the Olympic games, which may ſerve in ſome degree to mark the character of muſic at the time in which it happened. Lucian relates that a young flute-player named Harmonides, at his firſt public appearance in theſe games, began a ſolo with ſo violent a blaſt, on purpoſe to *ſurpriſe* and *elevate* the audience, that he *breathed his laſt breath into his flute*, and died on the ſpot. When to this anecdote, wonderful to us, and almoſt incredible, is added the circumſtance, that the trumpet-players at theſe public exhibitions expreſſed an exceſs of joy when they found their exertions had neither rent their cheeks nor burſt their blood-veſſels, ſome idea may be formed of the noiſy and vociferous ſtyle of muſic which then pleaſed ; and from ſuch facts only can any opinion be obtained of the actual ſtate of ancient muſic.

15 Vociferous muſic of the Greeks.

In whatever *manner* the flute was played on, there is no doubt that it was long in Greece an inſtrument of high favour, and that the flute-players were held in much eſtimation. The flute uſed by Iſmenias, a celebrated Theban muſician, coſt at Corinth three talents, or L. 581, 5 s. If, ſays Xenophon, a bad flute-player would paſs for a good one, he muſt, like the *great flute-players*, expend large ſums on *rich furniture*, and appear in public *with a great retinue of ſervants*.

16 Extravagance of the ancients with reſpect to muſic.

The ancients, it appears, were not leſs extravagant in gratifying the miniſters of their pleaſures than ourſelves

(†) Heſiod lived ſo near to Homer, that it has been diſputed which of them is the moſt ancient. It is now, we believe, univerſally admitted, that the palm of antiquity is due to Homer ; but we conſider them as having both flouriſhed in the ſame æra.

ſelves. Amœbæus, a harper, was paid an Attic talent, or L. 193, 15s. *per* day for his performance (‡).

It is proper to add, that the celebrated muſicians of Greece who performed in public were of *both* ſexes; and that the beautiful Lamia, who was taken captive by Demetrius, in the ſea engagement in which he vanquiſhed Ptolemy Soter, and who herſelf captivated her conqueror, as well as many other elevated female ſpirits, are recorded by ancient authors in terms of admiration, and of whom, did our limits here admit of biography, we would treat with pleaſure. The philoſophers of Greece, whoſe capacious minds graſped every other object of human intelligence, were not inattentive to the theory of muſic, or the philoſophy of ſound. This department of ſcience became the ſource of various ſects, and of much diverſity of opinion.—The founders of the moſt diſtinguiſhed ſects were Pythagoras and Ariſtoxenus. Of their theories, mention is made in the Appendix to this article.

17 Roman muſic.

Like every other people, the Romans, from their firſt origin as a nation, were poſſeſſed of a ſpecies of muſic which might be diſtinguiſhed as their own. It appears to have been rude and coarſe, and probably was a variation of the muſic in uſe among the Etruſcans and other tribes around them in Italy: but as ſoon as they began to open a communication with Greece, from that country, with their arts and philoſophy, they borrowed alſo their muſic and muſical inſtruments. No account, therefore, of Roman muſic is to be expected that would not be a repetition of what has been ſaid on the ſubject of the muſic of Greece.

18 Vanity of Nero with reſpect to muſic.

The exceſſive vanity of Nero with reſpect to muſic, diſplayed in his public contentions for ſuperiority with the moſt celebrated profeſſors of the art in Greece and Rome, is known to every one converſant in the hiſtory of Rome. The ſolicitude with which that deteſtable tyrant attended to his voice is curious, and will throw ſome light on the practices of ſingers in ancient times. He was in uſe to lie on his back, with a thin plate of lead on his ſtomach. He took frequent emetics and cathartics, abſtained from all kinds of fruit and ſuch meats as were held to be prejudicial to ſinging. Apprehenſive of injuring his voice, he at length deſiſted from haranguing the ſoldiery and the ſenate; and after his return from Greece eſtabliſhed an officer (Phonaſcus) to regulate his tones in ſpeaking.

19 Sacred muſic

Moſt nations have conſented in introducing muſic into their religious ceremonies. That art was early admitted into the rites of the Egyptians and Hebrews; and that it conſtituted a conſiderable part of the Grecian and Roman religious ſervice, appears from the writings of many ancient authors. The ſame pleaſing art ſoon obtained an introduction into the Chriſtian church, as the Acts of the Apoſtles diſcover in many paſſages. There remain no ſpecimens of the muſic employed in the worſhip of the primitive Chriſtians; but probably it was at firſt the ſame with that uſed in the Pagan rites of the Greeks and Romans. The practice of chanting the pſalms was introduced into the weſtern churches by St Ambroſe, about 350 years after Chriſt. In the year 600, the method of chanting was improved by St Gregory the Great. The Ambroſian chant contained four modes. In the Gregorian the number was doubled. So early as the age of Conſtantine the Great, prior to either of the periods laſt mentioned, when the Chriſtian religion firſt obtained the countenance of power, inſtrumental muſic came to be introduced into the ſervice of the church.

20 Introduced into the Engliſh church.

In England, according to biſhop Stillingfleet, muſic was employed in the church-ſervice, firſt by St Auguſtine, and afterwards much improved by St Dunſtan, who was himſelf an eminent muſician, and who is ſaid to have firſt furniſhed the Engliſh churches and convents with the organ. The organ, the moſt majeſtic of all inſtruments, ſeems to have been an improvement of the hydraulican or water organ of the Greeks.—The firſt organ ſeen in France was ſent from Conſtantinople in 757, as a preſent to king Pepin from the emperor Conſtantine Copromymus VI. In Italy, Germany, and England, that inſtrument became frequent during the 10th century.

During the dark ages no work of genius or taſte in any department of ſcience ſeems to have been produced in any part of Europe; and except in Italy, where the cultivation of muſic was rather more the object of attention, that art was neglected equally with all others. There has always been obſerved a correſpondence in every country between the progreſs of muſic and the cultivation of other arts and ſciences. In the middle ages, therefore, when the moſt fertile provinces of Europe were occupied by the Goths, Huns, Vandals, and other barbarous tribes, whoſe language was as harſh as their manners were ſavage, little perfection and no improvement of muſic is to be looked for. Literature, arts, and refinements, were encouraged more early at the courts of the Roman pontiffs than in any other country; and owing to that circumſtance it is, that the ſcale, the counterpoint, the beſt melodies, the dramas religious and ſecular, the chief graces and elegancies of modern muſic, have derived their origin from Italy. In modern times, Italy has been to the reſt of Europe what ancient Greece was to Rome. The Italians have aided the civilization of their conquerors, and enlightened the minds of thoſe whoſe ſuperior proweſs had enſlaved them.

21 The great improvements in muſic had their origin in Italy.

Having mentioned counterpoint, it would be improper not to make one or two obſervations on an invention which is ſuppoſed to have been the ſource of great innovation in the practice of muſic. Counterpoint, or muſic in parts, ſeems to be an invention purely modern. The term harmony meant in the language of antiquity what is now underſtood by melody. Guido, a monk of Arezzo in Tuſcany, is, in the general opinion, ſuppoſed to have entertained the firſt idea of counterpoint about the year 1022: an art which, ſince his time, has experienced gradual and imperceptible improvements, far exceeding the powers or comprehenſion of any one individual. The term *counterpoint*, or *contra punctum*, denotes its own etymology and import. Muſical notation was at one time performed by ſmall points; and the preſent mode is only

22 Counterpoint.

(‡) Roſcius gained 500 ſeſtertia, or L. 4036 : 9 : 2 d. Sterling *per* annum.

only an improvement of that practice. Counterpoint, therefore, denotes the notation of harmony or muſic in parts, by points oppoſite to each other. The improvements of this important acquiſition to the art of muſic kept pace at firſt with thoſe of the organ; an inſtrument admirably adapted to harmony: And both the one and the other were till the 13th century employed chiefly in ſacred muſic. It was at this period that ſecular muſic began to be cultivated.

Before the invention of characters for time, muſic in parts muſt have conſiſted entirely of *ſimple counterpoint*, or note againſt note, as is ſtill practiſed in pſalmody. But the happy diſcovery of a time-table extended infinitely the powers of combined ſounds. The ancients had no other reſource to denote time and movement in muſic except two characters (— ◡), equivalent to a long and a ſhort ſyllable. But time is of ſuch importance in muſic, that it can impart meaning and energy to the repetition of the ſame ſound: without it variety of tones has no effect with

22 [Th]e invention of the [tim]e-table.

reſpect to gravity and acuteneſs. The invention of the time-table is attributed by almoſt all the writers on muſic of the laſt and preſent century to John de Muris, who flouriſhed about the year 1330. But in a manuſcript of John de Muris himſelf, bequeathed to the Vatican library by the Queen of Sweden, that honour ſeems to be yielded to Magiſter Franco, who appears to have been alive as late at leaſt as 1083. John de Muris, however, who there is ſome cauſe to believe was an Engliſhman, though not the inventor of the *cantus menſurabilis*, did certainly by his numerous writings greatly improve it. His tract on the *Art of Counterpoint* is the moſt clear and uſeful eſſay on the ſubject of which thoſe times can boaſt.

In the 11th century, during the firſt cruſade, Europe began to emerge from the barbarous ſtupidity and ignorance which had long overwhelmed it. While its inhabitants were exerciſing in Aſia every ſpecies of rapine and pious cruelty, art, ingenuity, and reaſon, inſenſibly civilized and ſoftened their minds. Then it was that the poets and ſongſters, known by the name

23 [Tr]oubadours.

of *Troubadours*, who firſt appeared in Provence, inſtituted a new profeſſion; which obtained the patronage of the count of Poictou, and many other princes and barons, who had themſelves cultivated muſic and poetry with ſucceſs. At the courts of their munificent patrons the troubadours were treated with reſpect. The ladies, whoſe charms they celebrated, gave them the moſt generous and flattering reception. The ſucceſs of ſome inſpired others with hopes, and excited exertions in the exerciſe of their art; impelling them towards perfection with a rapidity which the united force alone of emulation and emolument could occaſion. Theſe founders of modern verſification, conſtructing their ſongs on plans of their own Claſſical authority, either through ignorance or deſign, was entirely diſregarded. It does not appear, however, during the cultivation and favour of Provençal literature, that any one troubadour ſo far outſtripped the reſt as to become a model of imitation. The progreſs of taſte muſt ever be impeded by the ignorance and caprice of thoſe who cultivate an art without ſcience or principles.

During almoſt two centuries after the arrangement of the ſcale attributed to Guido, and the invention of the time-table aſcribed to Franco, no remains of ſecular muſic can be diſcovered, except thoſe of the troubadours or Provençal poets. In the ſimple tunes of theſe bards no time indeed is marked, and but little variety of notation appears: it is not difficult, however, to diſcover in them the germs of the future melodies, as well as the poetry of France and Italy. Had the poetry and muſic of the troubadours been treated of in an agreeable manner by the writers who have choſen that ſubject, it would have been diſcovered to be worthy of attention: the poetry, as intereſting to literature; the melody to which it was ſung, as curious to the muſical hiſtorian.—Almoſt every ſpecies of Italian poetry is derived from the Provençals. *Air*, the moſt captivating part of ſecular vocal muſic, ſeems to have had the ſame origin. The moſt ancient ſtrains that have been ſpared by time, are ſuch as were ſet to the ſongs of the troubadours. The Provençal language began to be in favour with poets about the end of the 10th century. In the 12th it became the general vehicle, not only of poetry, but of proſe, to all who were ignorant of Latin. And theſe were not the laity only. At this period *violars*, or performers on the vielle or viol, *juglars* or flute-players, *muſars* or players on other inſtruments, and *comics* or comedians, abounded all over Europe. This ſwarm of poet-muſicians, who were formerly comprehended in France under the general title of *jongleurs*, travelled from province to province, ſinging their verſes at the courts of princes. They were rewarded with cloaths, horſes, arms, and money. Jongleurs or muſicians were employed often to ſing the verſes of troubadours, who themſelves happened to be deficient in voice or ignorant of muſic. The term *troubadour*, therefore, implies poetry as well as muſic. The jongleurs, menetriers, ſtrollers, or minſtrels, were frequently muſicians, without any pretenſions to poetry. Theſe laſt have been common at all times; but the troubadour or bard has diſtinguiſhed a particular profeſſion, either in ancient or modern times, only during the early dawnings of literature.

In the 13th century the ſongs were on various ſubjects; moral, merry, amorous: and at that time melody ſeems to have been little more than plain ſong or chanting. The notes were ſquare, and written on four lines only like thoſe of the Romiſh church in the cliff C, and without any marks for time. The movement and embelliſhments of the air depended on the abilities of the ſinger. Since that time, by the cultivation of the voice modern muſic has been much extended, for it was not till towards the end of St Lewis's reign that the fifth line began to be added to the ſtave. The ſinger always accompanied himſelf with an inſtrument in uniſon.

As the lyre is the favourite inſtrument in Grecian poetry, ſo the harp held the ſame place in the eſtimation of the poets who flouriſhed in the period of which we at preſent ſpeak. A poet of the 14th century, Machau, wrote a poem on the ſubject of the harp alone; in which he aſſigns to each of its 25 ſtrings an allegorical name; calling one *liberality*, another *wealth*, &c. 24 The harp the favourite inſtrument of the Troubadours.

The inſtrument which frequently accompanied, and indeed diſputed the pre-eminence with the harp, was the viol. Till the 16th century this inſtrument was furniſhed with frets; after that period it was reduced 25 The viol or violin.

to four strings: and still under the denomination of *violin* holds the first place among treble instruments. The viol was played with a bow, and differed entirely from the vielle, the tones of which were produced by the friction of a wheel; the wheel performed the part of a bow.

British harpers were famous long before the conquest. The bounty of William of Normandy to his *joculator* or bard is recorded in the Doomsday book. The harp seems to have been the favourite instrument in Britain for many ages, under the British, Saxon, Danish, and Norman kings. The *fiddle*, however, is mentioned so early as 1200 in the legendary life of St Christopher. The ancient privileges of the minstrels at the fairs of Chester are well known in the history of England.

The extirpation of the bards of Wales by Edward I. is likewise too familiar an incident to be mentioned here. His persecuting spirit, however, seems to have been limited to that principality; for we learn, that at the ceremony of knighting his son, a *multitude of minstrels* attended.

In 1315, during the reign of Edward II. such extensive privileges were claimed by the minstrels, and so many dissolute persons assumed that character, that it became necessary to restrain them by express laws.

26
St Cecilia.

The father of our genuine poetry, who in the 14th century enlarged our vocabulary, polished our numbers, and with acquisitions from France and Italy augmented our store of knowledge (Chaucer), entitles one of his poems The History of St Cecilia; and the celebrated patroness of music must no doubt be mentioned in a history of the art. Neither in Chaucer, however, nor in any of the histories or legendary accounts of this Saint, does any thing appear to authorise the religious veneration paid to her by the votaries of music; nor is it easy to discover whence it has arisen. As an incident relative to the period of which we speak, it may be mentioned, that, according to Spelmann, the appellation of *Doctor* was not among the degrees granted to graduates in England sooner than the reign of King John, about 1207; although, in Wood's history of Oxford, that degree is said to have been conferred, even in music, in the reign of Henry II. It is known that the title was created on the continent in the 12th century; and as, during the middle ages, music was always ranked among the seven liberal arts, it is likely that the degree was extended to it.

27
Origin of the degree of Mus. D.

After the invention of printing, an art which has tended to disseminate knowledge with wonderful rapidity among mankind, music, and particularly counterpoint, became an object of high importance. The names of the most eminent composers who flourished in England, from that time to the Reformation, were, Fairfax, William of Newark, Sheryngham, Turges, Banister, Tudor, Taverner, Tye, Johnson, Parsons; to whom may be added John Marbeck, who set the whole English cathedral service to music.

28
Scottish music.

Before this period Scottish music had advanced to a high degree of perfection. James I. was a great composer of airs to his own verses; and may be considered as the father of that plaintive melody which in Scotch tunes is so pleasing to a taste not vitiated by modern affectation. Besides the testimony of *Fordun* and *Major*, who may be suspected of being under the influence of national prejudice, we have that of Alessandro Tessani, to the musical skill of that accomplished prince. "Among us moderns (says this foreigner) we may reckon *James king of Scotland*, who not only composed many sacred pieces of vocal music, but also of himself *invented a new kind of music, plaintive and melancholy, different from all others*; in which he has *been imitated* by Carlo Gesueldo prince of Venosa, who in our age has improved music with new and admirable inventions."

Under such a genius in poetry and music as king James I. it cannot be doubted that the national music must have been greatly improved. We have seen that he composed several anthems, or vocal pieces of *sacred music*, which shows that his knowledge of the science must have been very considerable. It is likewise known, that organs were by him introduced into the cathedrals and abbeys of Scotland, and choir-service brought to such a degree of perfection, as to fall little short of that established in any country of Europe.—By an able antiquary † of the present age, the great era of music, as of poetry, in Scotland, is supposed to have been from the beginning of the reign of James I. down to the end of the reign of James V. During that period flourished *Gavin Douglas* bishop of Dunkeld, *Ballenden* archdeacon of Murray, *Dunbar*, *Henryson*, *Scott*, *Montgomery*, *Sir David Lindsey*, and many others, whose fine poems have been preserved in Banatyne's Collection, and of which several have been published by Allan Ramsay in his *Evergeen*.

† See *Tytler's Dissertation on the Scotch Music*, vol. i. the Transactions of the Society of Antiquaries in Scotland.

Before the Reformation, as there was but one religion, there was but one kind of sacred music in Europe, plain chant, and the descant built upon it.—That music likewise was applied to one language only, the Latin. On that account, the compositions of Italy, France, Spain, Germany, Flanders, and England, kept pace in a great degree with each other in style and excellence. All the arts seem to have been the companions, if not the produce, of successful commerce, and to have pursued the same course. Like commerce, they appeared first in Italy, then in the Hanseatic towns, next in the Netherlands; and during the 16th century, when commerce became general, in every part of Europe.

29
In the 16th century music an indispensable part of education.

In the 16th century music was an indispensable part of polite education; all the princes of Europe were instructed in that art. There is a collection preserved in manuscript called *Queen Elizabeth's Virginal Book*. If her majesty was able to execute any of the pieces in that book, she must have been a great player; a month's practice would not be sufficient for any master now in Europe to enable him to play one of them to the end. *Tallis*, singularly profound in musical composition, and *Bird* his admirable scholar, were two of the authors of this famous collection.

During the reign of Elizabeth, the genius and learning of the British musicians were not inferior to any on the continent; an observation scarcely applicable at any other period of the history of this country. Sacred music was the principal object of study all over Europe.

The most eminent musical theorists of Italy, who flourished in the 16th century, were, Franchinus Gafierius, or Gafforio of Lode, Pietro Aaron of Florence,

30 Eminent muſicians in Italy during the 16th century.

rence, Lodovico Fogliano, Giov. Spataro, Giov. Maria da Terentio Lanfranco, Steffano Uanneo, Anton. Franciſco Done, Luigi Dentice, Nicolo Vicentino, and Gioſeffo Zarlino, the moſt general, voluminous, and celebrated theoriſt of that period.

Vincentio Galilei, a Florentine nobleman, and father of the great Galileo Galilei.

Maria Artuſe of Bologna, Oraſeo Tegrini, Pietro Pontio, and Lodovico Zacconi.

The principal Roman authors were, Giovanni Anmuccia, Giovanni Pierluigi da Paleſtrina, juſtly celebrated; Ruggiero Giovanelli, Luca Marenzio, who brought to perfection madrigals, the moſt cheerful ſpecies of ſecular muſic.

Of the Venetians, Adrian Willaeri is allowed to be at the head.

At the head of the Neapolitans is deſervedly placed Rocco Rodio.

At Naples, too, the illuſtrious dilettante, Don Carlo Geſualdo prince of Venoſa, is highly celebrated. He ſeems, however, to have owed much of his fame to his high rank.

Lombardy would alſo furniſh an ample liſt of eminent muſicians during the 16th century, of whom our limits will not admit of a particular enumeration:— The chief of them were, Conſtanzo Porta, Gaſtoldi, Biffi, Cima, Vocchi, and Monteverde.

At Bologna, beſides Artuſi already mentioned, Andrea Rota of the ſame city appears to have been an admirable contrapunctiſt.

Franciſco Corteccia, a celebrated organiſt and compoſer, and Aleſſandro Strigglio, a lutaneſt and voluminous compoſer, were the moſt eminent Florentines.

31 In Germany.

The inhabitans of the extenſive empire of Germany have long made muſic a part of general education.— They hold the place, next Italy, among the moſt ſucceſsful cultivators of the art. During the 16th century, their moſt eminent compoſers of muſic and writers on the ſubject were, Geo. Reiſchius, Michael Roſwick, Andreas Ornithorparchus, Paul Hofhaimer, Luſpeinius, Henry Loris or Lorit, Faber, Fink, Hofman, and many others whom it would be tedious to mention; and for a particular account of whoſe treatiſes and compoſitions we muſt refer to more voluminous hiſtories of muſic.

32 In France.

In France, during the 16th century, no art except the art of war made much progreſs in improvement.— Ronſard, Baif, Goudimel, Claud le Jeune, Caurroy, and Maudit, are the chief French muſicians of that period.

33 Spain.

In Spain, muſic was early received into the circle of ſciences in the univerſities. The muſical profeſſorſhip at Salamanca was founded and endowed by Alforzo the Wiſe, king of Caſtile.

One of the moſt celebrated of the Spaniſh muſicians was Francis Salinas, who had been blind from his infancy. He was a native of Burgos.

D. Criſtofero Morales, and Tomaſo Lodovico da Vittorio, deſerve likewiſe to be mentioned; and to mention them is all we can attempt; the purpoſe of which is, to excite more minute inquiry by thoſe who may chooſe to inveſtigate the ſubject particularly.

34 The Netherlands.

The Netherlands, likewiſe, during the period of which we have been ſpeaking, produced many eminent compoſers; of whom we may mention Verletot, Gombert, Arkadelt, Berchem, Richefort or Ricciafort, Crequilon Le Cock or Le Coq, Canis, Jacob Clemens Non Papa, Pierre Manchicourt, Baſton, Kerl, Rore, Orlando di Laſſo, and his ſons Ferdinand and Rodolph.

35 Muſical compoſers in England during the 17th century.

In the 17th century, the muſical writers and compoſers who acquired fame in England, were, Dr Nathanael Giles, Thomas Tomkins, and his ſon of the ſame name; Elway Bevin, Orlando Gibbons, Dr William Child, Adrian Batten, Martin Pierſon, William Lawes, Henry Lawes, Dr John Wilſon, John Hilton, John Playford, Captain Henry Cook, Pelham Humphrey, John Blow, William Turner, Dr Chriſtopher Gibbons, Benjamin Rogers, and Henry Purcell. Of theſe, Orlando Gibbons, Pelham Humphrey, and Henry Purcell, far excelled the reſt.

About the end of the reign of James I. a muſic-lecture or profeſſorſhip was founded in the univerſity of Oxford by Dr William Hychin.

In the reign of Charles I. a charter was granted to the muſicians of Weſtminſter, incorporating them, as the king's muſicians, into a body politic, with powers to proſecute and fine all who, except themſelves, ſhould "attempt to make any benefit or advantage of muſic in England or Wales:" powers which in the ſubſequent reign were put in execution.

About the end of the reign of Charles II. a paſſion ſeems to have been excited in England for the violin, and for pieces expreſsly compoſed for it, in the Italian manner (*). Prior to 1600, there was little other muſic except maſſes and madrigals, the two principal diviſions of ſacred and ſecular muſic; but from that time to the preſent, dramatic muſic becomes the chief object of attention. The muſic of the church and of the chamber continued indeed to be cultivated in Italy with diligence, and in a learned and elaborate ſtyle, till near the middle of the century; yet a revolution in favour of melody and expreſſion was preparing, even in ſacred muſic, by the ſucceſs of dramatic compoſition, conſiſting of recitation and melodies for a ſingle voice. Such melodies began now to be preferred to muſic of many parts; in which canons, fugues, and full harmony, had been the productions which chiefly employed the maſter's ſtudy and the hearer's attention.

36 Mean ſtate of the opera in the beginning of the preſent century.

So late as the beginning of the preſent century, according to Riccoboni, the performers in the operas of Germany, particularly at Hamburg, "were all tradeſmen or handicrafts; your ſhoemaker (ſays he) was often the firſt performer on the ſtage; and you might have bought fruit and ſweetmeats of the ſame girls,

(*) The moſt celebrated violin players of Italy, from the 16th century to the preſent time, have been Farina, M. Angelo Roſſi, Baſſani the violin-maſter of Corelli, the admirable Angelico Corelli himſelf, Torelli, Alberti, Albenoni, Teſſarini, Vivaldi, Geminiani one of the moſt diſtinguiſhed of Corelli's ſcholars, Tartini, Veracini, Barbella, Locatelli, Ferrari, Martini, Boccherini, and Giardini.

girls, whom the night before you had feen in the characters of Armida or Semiramis. Soon, however, the German opera arofe to a more refpectable fituation; and even during the 17th century many eminent compofers flourifhed in that country.

The lift of great muficians which France produced during the early part of the fame century is not numerous. Mufic feems to have been but little cultivated in that country, till the operas of Lulli, under the powerful patronage of Louis XIV. excited public attention.

The favourite finging-mafter and compofer of France, about the middle of the 17th century, was Michael Lambert. John Baptift Lulli, foon after this time, rofe from the rank of a menial fervant to fame, opulence, and nobility, by his fkill in mufical compofitions. The celebrated finger La Rochois was taught finging and acting by Lulli.

37 Curious anecdotes of a French finger.

La Maupin the fucceffor of La Rochois, on account of her extraordinary character and romantic adventures, deferves to be mentioned. She was equally fond of both fexes, fought and loved like a man, refifted and fell like a woman. She eloped from her hufband with a fencing-mafter, of whom fhe learnt the fmall fword; fhe became an excellent fencer. At Marfeilles fhe became enamoured of a young lady, whom fhe feduced: on account of this whimfical affection the lady was by her friends confined in a convent. La Maupin obtained admiffion into the fame convent as a novice: fhe fet fire to the convent, and in the confufion carried off her favourite. At Paris, when fhe appeared on the ftage in 1695, Dumeni a finger having affronted her, fhe put on mens clothes, and infifted on his drawing his fword and fighting her: when he refufed, fhe caned him, and took from him his watch and fnuff-box as trophies of her victory. At a ball given by Monfieur brother of Louis XIV. fhe again put on mens clothes; and having behaved impertinently to a lady, three of the lady's friends, fuppofing the Maupin to be a man, called her out: fhe killed them all; and returning coolly to the ball, told the ftory to Monfieur, who obtained her pardon. She became afterwards miftrefs to the elector of Bavaria. This prince quitting her for the countefs of Arcos, fent her by the count, hufband of that lady, a purfe of L. 40,000 livres: fhe threw it at the count's head, telling him, it was a recompence worthy of fuch a fcoundrel and cuckold as himfelf. At laft, feized with a fit of devotion, fhe recalled her hufband, and fpent the remainder of her life in piety. She died in 1707 at the age only of 34.

38 Chief composers for the church in England.

The Englifh mufician whom we laft mentioned was the celebrated Purcell: after his time the chief compofers for the church were Clarke, Dr Holden, Dr Creyghton, Tucker, Aldrich, Golwin, Weldon, Dr Crofts, Dr Green, Boyce, and Nares; to whom may be added John Stanley, who attained high proficiency in mufic, although from two years old totally deprived of fight.

The annals of modern mufic have hitherto furnifhed no event fo important to the progrefs of the art as the invention of recitative or dramatic melody; a ftyle of mufic which refembles the manner of the ancient rhapfodifts.

The *Orfeo* of Politian was the firft attempt at mufical drama. It was afterwards perfected by Metaftafio. No mufical dramas fimilar to thofe afterwards known by the names of *opera* and *oratorio*, had exiftence in Italy before the beginning of the 17th century. It was above the 1600, or a little before that time, that eunuchs were firft employed for finging in Italy.

39 Firft mufical drama.

40 Firft finging eunuchs.

There feem to have been no *finging* eunuchs in ancient times, unlefs the galli or archigalli, priefts of Cybele, were fuch. Caftration has, however, at all times been practifed in eaftern countries, for the purpofe of furnifhing to tyrannic jealoufy guards of female chaftity; but never, fo far as modern writers on the fubject have difcovered, merely to preferve the voice, till about the end of the 16th century.

At Rome, the firft public theatre opened for the exhibition of mufical dramas, in modern times, was *il Torre de Nona*, where in 1671 Giafone was performed. In 1679, the opera of *Dou è Amore*, fet by the famous organift Bernardo Pafquini, was reprefented at *Nilla Sala de Signori Capranica*; a theatre which ftill fubfifts. In the year 1680, *L'Oncfta negl' Amore* was exhibited; the firft dramatic compofition of the elegant, profound, and original Aleffandro Scarlatti.

The inhabitants of Venice have cultivated and encouraged the mufical drama with more zeal and diligence than the reft of Italy, during the end of the laft and beginning of the prefent century; yet the opera was not eftablifhed in Venice before the year 1637; in that year the firft regular drama was performed: it was Andromeda.

41 Opera of Berenice.

In 1680 the opera of Berenice was exhibited at Padua with fuch aftonifhing fplendour as to merit notice. There were chorufes of 100 virgins, 100 foldiers, 100 horfemen in iron armour, 40 cornets of horfe, 6 trumpeters on horfeback, 6 drummers, 6 enfigns, 6 fackbuts, 6 great flutes, 6 minftrels playing on Turkifh inftruments, 6 others on octave flutes, 6 pages, 3 fergeants, 6 cymbalifts. There were 12 huntfmen, 12 grooms, 6 coachmen for the triumph, 6 others for the proceffion, 2 lions led by two Turks, 2 elephants by two others; Berenice's triumphal car drawn by 4 horfes, 6 other cars with prifoners and fpoils drawn by 12 horfes, 6 coaches. Among the fcenes and reprefentations in the firft act were, a vaft plain with two triumphal arches, another plain with pavilions and tents, and a foreft for the chace: in act third, the royal dreffing-room completely furnifhed, ftables with 100 live horfes, portico adorned with tapeftry, and a ftupendous palace in perfpective. At the end of the firft act were reprefentations of every kind of chace, wild boar, ftag, deer, bears. At the end of the third act, an enormous globe, defcended as from the fky, divided itfelf into other globes fufpended in the air, and ornamented with emblematical figures of time, fame, honour, &c.

Early in the laft century, machinery and decoration ufurped the importance due to poetry and mufic in fuch exhibitions.

Few inftances occur of mufical dramas at Naples till the beginning of the prefent century. Before the time of the elder Scarlatti, it feems as if Naples had been lefs fertile in great contrapuntifts, and lefs diligent in the cultivation of dramatic mufic, than any other ftate of Italy. Since that time all the reft of Europe

Europe has been furniſhed with compoſers and performers from that city.

42 French and Engliſh opera.

The word *opera* ſeems to have been familiar to Engliſh poets from the beginning of the laſt century. *Stilo recitativo*, a recent innovation even in Italy, is mentioned by Ben Johnſon ſo early as 1617. From this time it was uſed in maſques, occaſionally in plays, and in cantatas, before a regular drama wholely ſet to muſic was attempted. By the united abilities of Quinault and Lulli, the opera in France had ariſen to high favour. This circumſtance afforded encouragement to ſeveral attempts at dramatic muſic in England by Sir William D'Avenant and others, before the muſic, language, or performers of Italy were employed on our ſtage. Pieces, ſtyled *dramatic operas*, preceded the Italian opera on the ſtage of England. Theſe were written in Engliſh, and exhibited with a profuſe decoration of ſcenery and habits, and with the beſt ſingers and dancers that could be procured: Pſyche and Circe, are entertainments of this kind: the Tempeſt and Macbeth were acted with the ſame accompaniments.

During the 17th century, whatever attempts were made in muſical drama, the language ſung was always Engliſh. About the end of that century, however, Italian ſinging began to be encouraged, and vocal as well as inſtrumental muſicians from that country began to appear in London.

The firſt muſical drama, performed wholly after the Italian manner in recitative for the dialogue or narrative parts, and meaſured melody for the airs, was Arſinoe queen of Cyprus, tranſlated from an Italian opera of the ſame name, written by Stanzani of Bologna. The Engliſh verſion of this opera was ſet to muſic by Thomas Clayton, one of the royal band, in the reign of William and Mary. The ſingers were all Engliſh, Meſſrs Hughes, Leveredge, and Cook; Mrs Tofts, Mrs Croſs, and Mrs Lyndſey. The tranſlation of Arſinoe, and the muſic to which it is ſet, are execrable; yet ſuch is the charm of novelty, that this miſerable performance, deſerving neither the name of a drama by its poetry, nor of an opera by its muſic, ſuſtained 24 repreſentations, and the ſecond year 11.

Operas, notwithſtanding their deficiences in poetry, muſic, and performance (no foreign compoſer or eminent ſinger having yet arrived), became ſo formidable to our actors at the theatres, that it appears from the Daily Courant, 14th January 1707, a ſubſcription was opened "for the encouragement of the comedians acting in the Haymarket, and to enable them to keep the diverſion of plays under a ſeparate intereſt from operas."

Mr Addiſon's opera of Roſamond appeared about this time; but the muſic ſet by Clayton is ſo contemptible, that the merit of the poetry, however great, could not of itſelf long ſupport the piece. The choice of ſo mean a compoſer as Clayton, and Mr Addiſon's partiality to his abilities, betray a want of muſical taſte in that elegant author.

The firſt truly great ſinger who appeared on the ſtage of Britain was *Cavalier Nicolino Grimaldi*, commonly known by the name of *Nicolini*. He was a Neapolitan; and though a beautiful ſinger indeed, was ſtill more eminent as an actor. In the Tatler, n° 115. the elegance and propriety of his action are particularly deſcribed †. Recently before his appearance, *Valentini Urbani*, and a female ſinger called *The Baroneſs*, arrived. Margarita de l'Epini, who afterwards married Dr Pepuſch, had been in this country ſome time before.

† See alſo *Spectator*, vol. i. n° 13.

The firſt opera performed *wholly in Italian*, and *by Italian ſingers*, was *Almahide*. As at preſent, ſo at that time, operas were generally performed twice a-week.

43 Arrival of Handel in England.

The year 1710 is diſtinguiſhed in the annals of muſic by the arrival in Britain of George Frederick Handel. Handel had been in the ſervice of the elector of Hanover, and came firſt to England on a viſit of curioſity. The fame of this great muſician had penetrated into this country before he himſelf arrived in it; and Aaron Hill, then in the direction of the Haymarket theatre, inſtantly applied to him to compoſe an opera. It was Rinaldo; the admirable muſic of which he produced entirely in a fortnight. Soon after this period appeared, for the firſt time as an opera ſinger, the celebrated Mrs Anaſtaſia Robinſon. Mrs Robinſon, who was the daughter of a portrait painter, made her firſt public exhibitions in the concerts at York-buildings; and acquired ſo much the public favour, that her father was encouraged to take a houſe in Golden Square, for the purpoſe of eſtabliſhing weekly concerts and aſſemblies, in the manner of *Converſazioni*, which became the reſort of the moſt polite audiences.

Soon after Mrs Robinſon accepted of an engagement at the Opera, where her ſalary is ſaid to have been L. 1000, and her other emoluments equal to that ſum. She quitted the ſtage in conſequence of her marriage with the gallant earl of Peterborough, the friend of Pope and Swift. The eminent virtues and accompliſhments of this lady, who died a few years ago at the age of 88, entitled her to be mentioned even in a compend too ſhort for biography. The conducting of the opera having been found to be more expenſive than profitable, it was entirely ſuſpended from 1717 till 1720, when a fund of L. 50,000 for ſupporting and carrying it on was ſubſcribed by the firſt perſonages of the kingdom. The ſubſcribers, of whom king George I. was one for L. 1000, were formed into a ſociety, and named *The Royal Academy of Muſic*. Handel was commiſſioned to engage the performers: for that purpoſe he went to Dreſden, where Italian operas were at that time performed in the moſt ſplendid manner at the court of Auguſtus elector of Saxony, then king of Poland. Here Handel engaged Seneſino-Berenſtadt, Boſchi, and the Duranſtanti.

44 Progreſs of the opera under his management.

In the 1723, the celebrated Franceſca Cuzzoni appeared as a firſt-rate ſinger; and two years afterwards arrived her diſtinguiſhed rival Signora Fauſtina Bordoni.

In a cantabile air, though the notes Cuzzoni added were few, ſhe never loſt an opportunity of enriching the cantilena with the moſt beautiful embelliſhments. Her ſhake was perfect. She poſſeſſed a creative fancy; and ſhe enjoyed the power of occaſionally accelerating and retarding the meaſure in the moſt artificial and able manner, by what is in Italy called *tempo rubato*. Her high notes were unrivalled in clearneſs and ſweetneſs. Her intonations were ſo juſt and ſo fixed, that

it feemed as if fhe had not the power to fing out of tune.

Fauftina Bordoni, wife of the celebrated Saxon compofer Haffe, invented a new kind of finging, by running divifions, with a neatnefs and velocity which aftonifhed all who heard her. By taking her breath imperceptibly, fhe had the art of fuftaining a note apparently longer than any other finger. Her beats and trills were ftrong and rapid; her intonation perfect. Her profeffional perfections were enhanced by a beautiful face, fine fymmetry of figure, and a countenance and gefture on the ftage which indicated an entire intelligence and poffeffion of the feveral parts allotted to her.

Thefe two angelic performers excited fo fignally the attention of the public, that a party fpirit between the abettors of the one and of the other was formed, as violent and as inveterate almoft as any of thofe that had ever occurred relative to matters either theological or political; yet fo diftinct were their ftyles of finging, fo different their talents, that the praife of the one was no reproach to the other.

In lefs than feven years, the whole L. 50,000 fubfcribed by the Royal Academy, befides the produce of admiffion to non-fubfcribers, was expended, and the governor and directors of the fociety relinquifhed the idea of continuing their engagements; confequently, at the clofe of the feafon 1727, the whole band of fingers difperfed. The next year we find Senefino, Fauftina, Balde, Cuzzoni, Nicolini, Farinelli, and Bofche, at Venice.

Handel, however, at his own rifk, after a fufpenfion of about a twelvemonth, determined to recommence the Opera; and accordingly engaged a band of performers entirely new. Thefe were Signor Bernacchi, Signora Merighi, Signora Strada, Signor Anibale Pio Fabri, his wife, Signora Bertoldi, and John Godfrid Reimfchneider.

45 Invention of the oratorio, and its introduction into England.

The facred mufical drama, or oratorio, was invented early in the 14th century. Every nation in Europe feems firft to have had recourfe to religious fubjects for dramatic exhibitions. The oratorios had been common in Italy during the laft century; they had never been *publicly* introduced in England till Handel, ftimulated by the rivalfhip of other adventurers, exhibited in 1732 his oratorios of Efther, and of Acis, and Galatea, the laft of which he had compofed twelve years before for the duke of Chandos's chapel at Cannons. The moft formidable oppofition which Handel met with in his conduct of the Italian opera was a new theatre for exhibiting thefe operas, opened by fubfcription in Lincoln's-inn Fields, under the conduct of Nicola Porpora, a refpectable compofer. A difference having occurred between Handel and Senefino, Senefino had for fome time deferted the Haymarket, where Handel managed, and was now engaged at the rival theatre of Lincoln's-inn Fields. To fupply the place of Senefino, Handel brought over *Giovanni Careftini*, a finger of the moft extenfive powers. His voice was at firft a powerful and clear foprano; afterwards it changed into the fulleft, fineft, deepeft, counter-tenor that has perhaps ever been heard. Careftini's perfon was tall, beautiful, and majeftic. He rendered every thing he fung interefting by energy, tafte, and judicious embellifhment. In the execution of difficult divifions from the cheft, his manner was articulate and admirable. It was the opinion of Haffe, as well as other eminent profeffors, that whoever had not heard Careftini, was unacquainted with the moft perfect ftyle of finging. The opera under the direction of Porpora was removed to the Haymarket, which Handel had left. Handel occupied the theatre of Lincoln's-inn Fields; but his rivals now acquired a vaft advantage of attraction, by the acceffion of Carlo Brofchi detto Farinelli to their party, who at this time arrived. This renowned finger feems to have tranfcended the limits of all anterior vocal excellence. No vocal performer of the prefent century has been fo unanimoufly allowed to poffefs an uncommon power, fweetnefs, extent, and agility of voice, as Farinelli. Nicolini, Senefino, and Careftini, gratified the eye as much by the dignity, grace, and propriety of their action and deportment, as the ear, by the judicious ufe of a few notes within the limits of a fmall compafs of voice; but Farinelli, without the affiftance of fignificant geftures or graceful attitudes, enchanted and aftonifhed his hearers, by the force, extent, and mellifluous tones of the mere organ, when he had nothing to execute, articulate, or exprefs. Though during the time of finging he was as motionlefs as a ftatue, his voice was fo active that no intervals were too clofe, too wide, or too rapid, for his execution.

Handel having loft a great part of his fortune by the opera, was under the neceffity of trying the public gratitude in a benefit, which was not difgraced by the event: the theatre, for the honour of the nation, was fo crowded, that he is faid to have cleared L. 800.

46 Opera in England given up.

After a fruitlefs attempt by Heidegger, the coadjutor of Handel in the conduct of the opera, and patentee of the King's Theatre in Haymarket, to procure a fubfcription for continuing it, it was found neceffary to give up the undertaking.

It was about this time that the ftatue of Handel was erected in Vauxhall, at the expence of Mr Tyers, proprietor of thofe gardens.

The next year (1739) Handel carried on oratorios at the Haymarket, as the opera there was fufpended. The earl of Middlefex now undertook the troublefome office of *imprefario* of the Italian opera. He engaged the King's theatre, with a band of fingers from the Continent almoft entirely new. Caluppi was his compofer. Handel, almoft ruined, retired at this time to Ireland, where he remained a confiderable time. In 1744 he again attempted oratorios at the King's theatre, which was then, and till 1746, unoccupied by the opera, on account of the rebellion. 47 Revived.

The arrival of Giardini in London this year forms a memorable æra in the inftrumental mufic of England. His powers on the violin were unequalled. The fame year Dr Croza, then manager of the opera, eloped, leaving the performers, and innumerable trades-people, his creditors. This incident put an end to operas of all kinds for fome time.

This year a comic opera, called *Il Filofofo di Campagna*, compofed by Caluppi, was exhibited, which furpaffed in mufical merit all the comic operas performed in England till the *Bicona Figliula*. Signora Paganini acquired fuch fame by the airs allotted to her in that piece, that the crowds at her benefit were beyond example. Caps were loft, gowns torn in pieces,

pieces, and ladies in full dreſs, without ſervants or carriages, were obliged to walk home, amidſt the merriment of the ſpectators on the ſtreets.

48 64 and 65, anzoli. At this period the arrival of Giovanni Manzoli marked a ſplendid æra in the annals of muſical drama, by conferring on ſerious opera a degree of importance to which it had ſeldom yet ariſen ſince its eſtabliſhment in England. Manzoli's voice was the moſt powerful and voluminous ſoprano that had been heard ſince the time of Farinelli: his manner of ſinging was grand, and full of taſte and dignity.

49 enducci. At this time Tenducci, who had been in England ſome time before, and was now returned much improved, performed in the ſtation of ſecond man to Manzoli.

50 1769. uadagni. Gaetano Guadagni made a great figure at this time. He had been in this country early in life (1748), as ſerious-man in a burletta troop of ſingers. His voice was then a full and well-toned counter-tenor; but he ſung wildly and careleſsly. The excellence of his voice, however, attracted the notice of Handel, who aſſigned him the parts in his oratorios the Meſſiah and Samſon, which had been originally compoſed for Mrs Cibber. He quitted London for the firſt time about 1753. The higheſt expectations of his abilities were raiſed by fame before his ſecond arrival, at the time of which we treat. As an actor he ſeems to have had no equal on any ſtage in Europe. His figure was uncommonly elegant and noble; his countenance replete with beauty, intelligence, and dignity; his attitudes were full of grace and propriety. Thoſe who remembered his voice when formerly in England were now diſappointed: it was comparatively thin and feeble; he had now changed it to a ſoprano, and extended its compaſs from ſix or ſeven notes to fourteen or fifteen. The muſic he ſung was the moſt ſimple imaginable; a few notes with frequent pauſes, and opportunities of being liberated from the compoſer and the band, were all he required. In theſe effuſions, ſeemingly extemporaneous, he diſplayed the native power of melody unaided by harmony or even by uniſonous accompaniment: the pleaſure he communicated proceeded principally from his artful manner of diminiſhing the tones of his voice, like the dying notes of the Æolian harp. Moſt other ſingers affect a ſwell, or *meſſa de voce;* but Guadagni, after beginning a note with force, attenuated it ſo delicately that it poſſeſſed all the effect of extreme diſtance. During the ſeaſon 1770 and 1771, Tenducci was the immediate ſucceſſor of Guadagni. This performer, who appeared in England firſt only as a ſinger of the ſecond or third claſs, was during his reſidence in Scotland and Ireland ſo much improved as to be well received as firſt man, not only on the ſtage of London but in all the great theatres of Italy.

It was during this period that dancing ſeemed firſt to gain the aſcendant over muſic by the ſuperior talents of Mademoiſelle Heinel, whoſe grace and execution were ſo perfect as to eclipſe all other excellence.

51 1773. iſs Daes. In the firſt opera performed this ſeaſon (*Lucco Vero*) appeared Miſs Cecilia Davies, known in Italy by the name of L'Ingleſina. Miſs Davies had the honour of being the firſt Engliſh woman who had ever been thought worthy of ſinging on any ſtage in Italy. She even performed with eclat the principal female characters on many of the great theatres of that country. Gabrielli only on the Continent was ſaid to ſurpaſs her. Her voice, though not of great volume, was clear and perfectly in tune; her ſhake was open and diſtinct, without the ſluggiſhneſs of the French cadence. The flexibility of her throat rendered her execution equal to the moſt rapid diviſions.

Next ſeaſon introduced Venanzio Ravygini, a beautiful and animated young man; a compoſer as well as a ſinger.—His voice was ſweet, clear, flexible; in compaſs more than two octaves.

The ſeaſon 1775 and 1776 was rendered memorable by the arrival of the celebrated *Caterina Gabrielli*, ſtyled early in life *La Cuochetina*, being the daughter of a cardinal's cook at Rome. She had, however, in her countenance and deportment no indications of low birth. Her manner and appearance depicted dignity and grace. So great was her reputation before her arrival in England for ſinging and for caprice, that the public expecting perhaps in both too much, were unwilling to allow her due praiſe for her performance, and were apt to aſcribe every thing ſhe did to pride and inſolence. Her voice, though exquiſite, was not very powerful. Her chief excellence having been the neatneſs and rapidity of her execution, the ſurpriſe of the public muſt have been much diminiſhed on hearing her after Miſs Davies, who ſung many of the ſame ſongs in the ſame ſtyle, and with a neatneſs ſo nearly equal, that common hearers could diſtinguiſh no difference. The diſcriminating critic, however, might have diſcovered a ſuperior ſweetneſs in the natural tone of the Gabrielli's voice, an elegance in the finiſhing of her muſical periods or paſſages, an accent and preciſion in her diviſions, ſuperior not only to Miſs Davies, but to every other ſinger of her time. In ſlow movements her pathetic powers, like thoſe in general of performers moſt renowned for agility, were not exquiſitely touching. She now reſides at Bologna. 52 Caterina Gabrielli.

About the time of which we have been treating, the proprietors of the Pantheon ventured to engage the *Agujari* at the enormous ſalary of L. 100 *per* night, for ſinging two ſongs only! *Lucrezia Agujari* was a truly wonderful performer. The lower part of her voice was full, round, and of excellent quality; its compaſs amazing. She had two octaves of fair natural voice, from A on the fifth line in the baſs to A on the ſixth line in the treble, and beyond that in *alt* ſhe had in early youth more than another octave. She has been heard to aſcend to B b *in altiſſimo*. Her ſhake was open and perfect; her intonation true; her execution marked and rapid; the ſtyle of her ſinging, in the natural compaſs of her voice, grand and majeſtic. 53 Agujari at the Pantheon.

In 1776 arrived Anna Pozzi, as ſucceſſor to the Gabrielli. She poſſeſſed a voice clear, ſweet, and powerful; but her inexperience, both as an actreſs and as a ſinger, produced a contraſt very unfavourable to her when compared with ſo celebrated a performer as Gabrielli. Since that time, however, Pozzi, with more ſtudy and knowledge, has become one of the beſt and moſt admired female ſingers in Italy. 54 Anna Pozzi.

After the departure of Agujari for the ſecond and laſt time, the managers of the Pantheon engaged the *Georgi* as her ſucceſſor. Her voice was exquiſitely fine, but 55 Georgi.

but totally uncultivated. She is now employed as the firſt woman in the operas of the principal cities of Italy.

56 Roncaglia and Danze.

During the ſeaſons 1777 and 1778, the principal ſingers at the opera in London were Frandeſco Roncaglia and Franceſca Danze, afterwards Madame Le Brun.

Roncaglia poſſeſſed a ſweet-toned voice; but of the three great requiſites of a complete ſtage-ſinger, pathos, grace, and execution, which the Italians call *cantabile*, *grazioſa*, and *bravura*, he could lay claim only to the ſecond. His voice, a *voce de camera*, when confined to the *grazioſa* in a room, leaves nothing to wiſh for.

Danze had a voice well in tune, a good ſhake, great execution, prodigious compaſs, with great knowledge of muſic; yet the pleaſure her performance imparted was not equal to theſe accompliſhments: but her object was not ſo much pathos and grace, as to ſurpriſe by the imitation of the tone and difficulties of inſtruments.

57 Pacchierotti.

This year *Gaſparo Pacchierotti* appeared in London, whither his high reputation had penetrated long before. The natural tone of his voice is intereſting, ſweet, and pathetic. His compaſs downwards is great, with an aſcent up to B b, and ſometimes to C *in alt*. He poſſeſſes an unbounded fancy, and the power not only of executing the moſt difficult and refined paſſages, but of inventing embelliſhment entirely new. *Ferdinando Bertoni*, a well-known compoſer, came along with Pacchierotti to Britain.

58 Dancing gains the aſcendant over muſic at the opera-houſe.

During the laſt ten years, dancing has become an important branch of the amuſements of the opera-houſe. Mademoiſelle Hemel, M. Veſtris le Jeune, Mademoiſelle Baccelli, had, during ſome years, delighted the audience at the opera; but on the arrival of M. Veſtris l'Aine, pleaſure was exchanged for ecſtaſy. In the year 1781, Pacchierotti had by this time been ſo frequently heard that his ſinging was no impediment to converſation; but while the elder Veſtris was on the ſtage, not a breathing was to be heard. Thoſe lovers of muſic who talked the loudeſt while Pacchierotti ſung, were in agonies of terror leſt the graceful movements of Veſtris, *le dieu de la dance*, ſhould be diſturbed by audible approbation. Since that time, the moſt mute and reſpectful attention has been paid to the manly grace of Le Picq, and the light fantaſtic toe of the younger Veſtris; to the Roſſis, the Theodores, the Coulons, the Hillingſburgs; while the ſlighted ſingers have been diſturbed, not by the violence of applauſe, but the clamour of inattention.

59 Commemoration of Handel in Weſtminſter Abbey.

The year 1784 was rendered a memorable era in the annals of muſic by the ſplendid and magnificent manner in which the birth and genius of Handel were celebrated in Weſtminſter Abbey and the Pantheon, by five performances of pieces ſelected from his own works, and executed by a band of more than 500 voices and inſtruments, in the preſence and under the immediate auſpices of their majeſties and the firſt perſonages of the kingdom. The commemoration of Handel has been ſince eſtabliſhed as an annual muſical feſtival for charitable purpoſes; in which the number of performers and the perfection of the performances have continued to increaſe. In 1785 the band, vocal and inſtrumental, amounted to 616; in 1786 to 741; in 1787 to 806.

Dr Burney publiſhed An Account of the Muſical Performances in Commemoration of Handel, for the benefit of the Muſical Fund. The members and guardians of that fund are now incorporated under the title of *Royal Society of Muſicians*. See Handel.

This year Pacchierotti and his friend Bertoni left England. About the ſame time our country was deprived of the eminent compoſer Sacchini, and Giardini the greateſt performer on the violin then in Europe.

60 Excellence of Madam Mara.

As a compenſation for theſe loſſes, this memorable year is diſtinguiſhed by the arrival of Madam Mara, whoſe performance in the commemoration of Handel in Weſtminſter Abbey inſpired an audience of 3000 of the firſt people of the kingdom, not only with pleaſure but with ecſtaſy and rapture.

61 Rubinelli.

In 1786 arrived *Giovanni Rubinelli*. His voice is a true and full contralto from C in the middle of the ſcale to the octave above. His ſtyle is grand; his execution neat and diſtinct; his taſte and embelliſhments new, ſelect, and maſterly.

62 A new dance by M. Noverre.

In 1788 a new dance, compoſed by the celebrated M. Noverre, called *Cupid and Pſyche*, was exhibited along with the opera *La Locandiera*, which produced an effect ſo uncommon as to deſerve notice. So great was the pleaſure it afforded to the ſpectators, that Noverre was unanimouſly brought on the ſtage and crowned with laurel by the principal performers. This, though common in France, was a new mark of approbation in England.

63 Marcheſi.

This year arrived Signor Luige Marcheſi, a ſinger whoſe talents have been the ſubject of praiſe and admiration on every great theatre of Europe. Marcheſi's ſtyle of ſinging is not only elegant and refined in an uncommon degree, but often grand and full of dignity, particularly in his recitative and occaſional low notes. His variety of embelliſhment and facility of running extempore diviſions are wonderful. Many of his graces are elegant and of his own invention.

64 Diſcriminated characters of Pacchierotti, Rubinelli, and Marcheſi.

The three greateſt Italian ſingers of the preſent times are certainly Pacchierotti, Rubinelli, and Marcheſi. In diſcriminating the ſeveral excellencies of theſe great performers, a very reſpectable judge, Dr Burney, has particularly praiſed the ſweet and touching voice of Pacchierotti; his fine ſhake, his exquiſite taſte, his great fancy, and his divine expreſſion in pathetic ſongs: Of Rubinelli's voice, the fulneſs, ſteadineſs, and majeſty, the accuracy of his intonations, his judicious graces: Of Marcheſi's voice, the elegance and flexibility, his grandeur in recitative, and his boundleſs fancy and embelliſhments.—Having mentioned Dr Burney, we are in juſtice bound to acknowledge the aid we have derived from his hiſtory; a work which we greatly prefer to every other modern production on the ſubject. During the latter part of the preſent century many eminent compoſers have flouriſhed on the continent; ſuch as Jomelli, the family of the Bachs, Gluck, Haydn, and many others, whoſe different ſtyles and excellencies would well deſerve to be particulariſed, would our limits permit.

65 Sovereign princes dilettanti.

With the ſame regard to brevity, we can do no more than juſt mention the late king of Pruſſia, the late elector of Bavaria, and prince Lobkowitz, as eminent dilettanti of modern times.

Beſides the opera-ſingers whom we have mentioned, our

66 ngers on eatresand ublic rdens.

our theatres and public gardens have exhibited ſingers of conſiderable merit. In 1730 Miſs Rafter, afterwards the celebrated Mrs Clive, firſt appeared on the ſtage at Drury-lane as a ſinger. The ſame year introduced Miſs Cecilia Young, afterward the wife of Dr Arne. Her ſtyle of ſinging was infinitely ſuperior to that of any other Engliſh woman of her time.

67 avourite uſicians.

Our favourite muſicians at this time were, Dubourg, Clegg, Clarke, and Feſting, on the violin; Kytch on the hautboy; Jack Feſting on the German flute; Baſton on the common flute; Karba on the baſſoon; Valentine Snow on the trumpet: and on the organ, Roſeingrave, Green, Robinſon, Magnus, Jack James, and the blind Stanley, who ſeems to have been preferred. The favourite playhouſe ſinger was Salway; and at concerts Mountier of Chicheſter.

As compoſers for our national theatre, Pepuſch and Galliard ſeem to have been unrivalled till 1732; when two competitors appeared, who were long in poſſeſſion of the public favour: We allude to John Frederick Lampe and Thomas Auguſtus Arne.

In 1736 Mrs Cibber, who had captivated every hearer of ſenſibility by her native ſweetneſs of voice and powers of expreſſion as a ſinger, made her firſt attempt as a tragic actreſs. The ſame year Beard became a favourite ſinger at Covent-garden. At this time Miſs Young, afterwards Mrs Arne, and her two ſiſters Iſabella and Eſther, were the favourite Engliſh female ſingers.

68 und for ecayed uſicians.

In 1738 was inſtituted the fund for the ſupport of decayed muſicians and their families.

It was in 1745 that Mr Tyers, proprietor of Vauxhall gardens, firſt added vocal muſic to the other entertainments of that place. A ſhort time before Ranelagh had become a place of public amuſement.

69 rival of iardini.

In 1749 arrived Giardini, whoſe great taſte, hand, and ſtyle in playing on the violin, procured him univerſal admiration. A few years after his arrival he formed a morning *academia* or concert at his houſe, compoſed chiefly of his ſcholars.

About this time San Martini and Charles Aviſon were eminent compoſers.

70 yle of rne.

Of near 150 muſical pieces brought on our national theatres within theſe 40 years, 30 of them at leaſt were ſet by Arne. The ſtyle of this compoſer, if analyſed, would perhaps appear to be neither Italian nor Engliſh; but an agreeable mixture of both and of Scotch.

71 he earl of elly.

The late earl of Kelly, who died but a few years ago, deſerves particular notice, as poſſeſſed of a very eminent degree of muſical ſcience, far ſuperior to other dilettanti, and perhaps not inferior to any profeſſor of his time. There was no part of theoretical or practical muſic in which he was not thoroughly verſed: He poſſeſſed a ſtrength of hand on the violin, and a genius for compoſition, with which few profeſſors are gifted.

72 Abel.

Charles Frederic Abel was an admirable muſician: his performance on the viol da gamba was in every particular complete and perfect. He had a hand which no difficulties could embarraſs; a taſte the moſt refined and delicate; a judgment ſo correct and certain as never to permit a ſingle note to eſcape him without meaning. His compoſitions were eaſy and elegantly ſimple. In writing and playing an *adagio* he was ſuperior to all praiſe; the moſt pleaſing yet learned modulation, the richeſt harmony, the moſt elegant and poliſhed melody, were all expreſſed with the moſt exquiſite feeling, taſte, and ſcience. His manner of playing an adagio ſoon became the model of imitation for all our young performers on bowed inſtruments. Bartholemon, Cervetto, Cramer, and Croſdil, may in this reſpect be ranked as of his ſchool. All lovers of muſic muſt have lamented that Abel in youth had not attached himſelf to an inſtrument more worthy of his genius, taſte, and learning, than the viol da gamba, that remnant of the old cheſt of viols which during the laſt century was a neceſſary appendage of a nobleman's or gentleman's family throughout Europe, previous to the admiſſion of violins, tenors, and baſes, in private houſes or public concerts. Since the death of the late elector of Bavaria, who was next to Abel (the beſt performer on the viol da gamba in Europe), the inſtrument ſeems quite laid aſide. It was uſed longer in Germany than elſewhere; but the place of gambiſt ſeems now as much ſuppreſſed in the chapels of German princes as that of lutaniſts. The celebrated performer on the violin, Lolle, came to England in 1785. Such was his caprice, that he was ſeldom heard; and ſo eccentric was his ſtyle and compoſition, that by many he was regarded as a madman. He was, however, during his lucid intervals a very great and expreſſive performer in the ſerious ſtyle.

Mrs Billington, after diſtinguiſhing herſelf in childhood as a neat and expreſſive performer on the piano-forte, appeared all at once in 1786 as a ſweet and captivating ſinger. In emulation of the Mara and other great bravura ſingers, ſhe at firſt too frequently attempted paſſages of difficulty; now, however, ſo greatly has ſhe improved, that no ſong ſeems too high or too rapid for her execution. The natural tone of her voice is ſo exquiſitely ſweet, her knowledge of muſic ſo conſiderable, her ſhake ſo true, her cloſes and embelliſhments ſo various, her expreſſions ſo grateful, that envy only or apathy could hear her without delight. The preſent compoſers, and performers of the firſt claſs, are ſo well known to the lovers of the art, that it would be needleſs and improper to mention them particularly: and to deſcribe the diſtinctive powers of Bartholemon, Cramer, Pieltain, Raimonde, and Salamon, would be too delicate a taſk for us to undertake. 73 Mrs Billington.

The Catch-club at the Thatched Houſe, inſtituted in 1762 by the late earl of Eglinton, the preſent duke of Queenſberry, and others; and the concert of ancient muſic, ſuggeſted by the earl of Sandwich in 1776, have had a beneficial effect in improving the art. [73] The catch-club and the concert of ancient muſic.

We have been ſomewhat particular in our account of muſical affairs in our own country during the preſent century, as what would be moſt intereſting to general readers, and of which a well-informed gentleman would not wiſh to be ignorant. The profeſſor and connoiſſeur is not to be expected to content himſelf with diſquiſitions much more minute than thoſe of which our limits can be ſuppoſed to admit.

ELEMENTS OF MUSIC.

Theoretical and Practical (†).

PRELIMINARY DISCOURSE.

74 Muſic conſidered in a double view.

MUSIC may be conſidered, either as an art, which has for its object one of the greateſt pleaſures of which our ſenſes (‡) are ſuſceptible; or as a ſcience, by which that art is reduced to principles. This is the double view in which we mean to treat of muſic in this work.

75 Progreſs of muſic like that of other arts and ſciences.

It has been the caſe with muſic as with all the other arts invented by men: ſome facts were at firſt diſcovered by accident; ſoon afterwards reflection and obſervation inveſtigated others; and from theſe facts, properly diſpoſed and united, philoſophers were not ſlow in forming a body of ſcience, which afterwards increaſed by degrees.

The firſt theories of muſic were perhaps as ancient as the earlieſt age which we know to have been diſtinguiſhed by philoſophy, even as the age of Pythagoras; nor does hiſtory leave us any room to doubt, that from the period when that philoſopher taught, the ancients cultivated muſic, both as an art and as a ſcience, with great aſſiduity. But there remains to us much uncertainty concerning the degree of perfection to which they brought it. Almoſt every queſtion which has been propoſed with reſpect to the muſic of the ancients has divided the learned; and may probably ſtill continue to divide them, for want of monuments ſufficient in their number, and inconteſtable in their nature, from whence we might be enabled to exhibit teſtimonies and diſcoveries inſtead of ſuppoſitions and conjectures. In the preceding hiſtory we have ſtated a few facts reſpecting the nature of ancient muſic, and the inventors of the ſeveral muſical inſtruments; but it were to be wiſhed, that, in order to elucidate, as much as poſſible, a point ſo momentous in the hiſtory of the ſciences, ſome perſon of learning, equally ſkilled in the Greek language and in muſic, ſhould exert himſelf to unite and diſcuſs in the ſame work the moſt probable opinions eſtabliſhed or propoſed by the learned upon a ſubject ſo difficult and curious. This philoſophical hiſtory of ancient muſic is a work which might highly embelliſh the literature of our times.

76 The hiſtory of muſic a deſideratum in literature.

In the mean time, till an author can be found ſufficiently inſtructed in the arts and in hiſtory to undertake ſuch a labour with ſucceſs, we ſhall content ourſelves with conſidering the preſent ſtate of muſic, and limit our endeavours to the explication of thoſe acceſſions which have accrued to the theory of muſic in theſe latter times.

There are two departments in muſic, melody * and harmony †. Melody is the art of arranging ſeveral ſounds in ſucceſſion one to another in a manner agreeable to the ear; harmony is the art of pleaſing that organ by the union of ſeveral ſounds which are heard at one and the ſame time. Melody has been known and felt through all ages: perhaps the ſame cannot be affirmed of harmony (§); we know not whether the ancients made any uſe of it or not, nor at what period it began to be practiſed.

* See *Melody*
† See *Harmony*.

Not but that the ancients certainly employed in their muſic

(†) To deliver the elementary principles of muſic, theoretical and practical, in a manner which may prove at once entertaining and inſtructive, without protracting this article much beyond the limits preſcribed in our plan, appears to us no eaſy taſk. We therefore heſitated for ſome time, whether to try our own ſtrength, or to follow ſome eminent author on the ſame ſubject. Of theſe the laſt ſeemed preferable. Amongſt theſe authors, none appeared to us to have written any thing ſo fit for our purpoſe as M. D'Alembert, whoſe treatiſe on muſic is the moſt methodical, perſpicuous, conciſe, and elegant diſſertation on that ſubject with which we are acquainted. As it was unknown to moſt Engliſh readers before the former edition of this work, it ought to have all the merit of an original. We have given a faithful tranſlation of it; but in the notes, ſeveral remarks are added, and many authors quoted, which will not be found in the original. It is a work ſo ſyſtematically compoſed, that all attempts to abridge it, without rendering it obſcure and imperfect, would be impracticable. It is perhaps impoſſible to render the ſyſtem of muſic intelligible in a work of leſs compaſs than that with which our readers are now preſented; and, in our judgment, a performance of this kind, which is written in ſuch a manner as not to be generally underſtood, were much better ſuppreſſed.

(‡) In this paſſage, and in the definitions of melody and harmony, our author ſeems to have adopted the vulgar error, that the pleaſures of muſic terminates in corporeal ſenſe. He would have pronounced it abſurd to aſſert the ſame thing of painting. Yet if the former be no more than a mere pleaſure of corporeal ſenſe, the latter muſt likewiſe be ranked in the ſame predicament. We acknowledge that corporeal ſenſe is the vehicle of ſound; but it is plain from our immediate feelings, that the reſults of ſound arranged according to the principles of melody, or combined and diſpoſed according to the laws of harmony, are the objects of a reflex or internal ſenſe.

For a more ſatisfactory diſcuſſion of this matter, the reader may conſult that elegant and judicious treatiſe on Muſical Expreſſion by Mr Aviſon. In the mean time it may be neceſſary to add, that, in order to ſhun the appearance of affectation, we ſhall uſe the ordinary terms by which muſical ſenſations, or the mediums by which they are conveyed, are generally denominated.

(§) Though no certainty can be obtained what the ancients underſtood of harmony, nor in what manner and in what period they practiſed it; yet it is not without probability, that, both in ſpeculation and practice, they

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music those chords which were most perfect and simple; such as the octave, the fifth, and the third; but it seems doubtful whether they knew any of the other consonances or not, or even whether in practice they could deduce the same advantages from the simple chords which were known to them, that have afterwards accrued from experience and combinations.

If that harmony which we now practice owes its origin to the experience and reflection of the moderns, there is the highest probability that the first essays of this art, as of all the others, were feeble, and the progress of its efforts almost imperceptible; and that, in the course of time, improving by small gradations, the successive labours of several geniuses have elevated it to that degree of perfection in which at present we find it.

77 The origin of arts often accidental, and their progress gradual.

The first inventor of harmony escapes our investigation, from the same causes which leave us ignorant of those who first invented each particular science; because the original inventors could only advance one step, a succeeding discoverer afterwards made a more sensible improvement, and the first imperfect essays in every kind were lost in the more extensive and striking views to which they led. Thus the arts which we now enjoy, are for the most part far from being due to any particular man, or to any nation exclusively: they are produced by the united and successive endeavours of mankind; they are the results of such continued and united reflections, as have been formed by all men at all periods and in all nations.

It might, however, be wished, that after having ascertained, with as much accuracy as possible, the state of ancient music by the small number of Greek authors which remain to us, the same application were immediately directed to investigate the first incontestable traces of harmony which appear in the succeeding ages, and to pursue those traces from period to period. The products of these researches would doubtless be very imperfect, because the books and monuments of the middle ages are by far too few to enlighten that gloomy and barbarous era; yet these discoveries would still be precious to a philosopher, who delights to observe the human mind in the gradual evolutions of its powers, and the progress of its attainments.

78 Delineations of the laws of harmony recent and imperfect.

The first compositions upon the laws of harmony which we know, are of no higher antiquity than two ages prior to our own; and they were followed by many others. But none of these essays was capable of satisfying the mind concerning the principles of harmony: they confined themselves almost entirely to the single occupation of collecting rules, without endeavouring to account for them; neither had their analogies one with another, nor their common source, been perceived; a blind and unenlightened experience was the only compass by which the artist could direct and regulate his course.

79 Its precepts not deduced from any principle till by M. Rameau.

M. Rameau was the first who began to transfuse light and order through this chaos. In the different tones produced by the same sonorous body, he found the most probable origin of harmony, and the cause of that pleasure which we receive from it. His principle he unfolded, and showed how the different phenomena of music were produced by it: he reduced all the consonances to a small number of simple and fundamental chords, of which the others are only combinations or various arrangements. He has, in short, been able to discover, and render sensible to others, the mutual dependence between melody and harmony.

80 The author's motives for writing these elements.

Though these different topics may be contained in the writings of this celebrated artist, and in these writings may be understood by philosophers who are likewise adepts in the art of music; still, however, such musicians as were not philosophers, and such philosophers as were not musicians, have long desired to see these objects brought more within the reach of their capacity: such is the intention of the treatise I now present to the public. I had formerly composed it for the use of some friends. As the work appeared to them clear and methodical, they have engaged me to publish it, persuaded (though perhaps with too much credulity) that it might be useful to facilitate the progress of initiates in the study of harmony.

This was the only motive which could have determined me to publish a book of which I might without hesitation assume the honour, if its materials had been the fruits of my own invention, but in which I can now boast no other merit than that of having developed, elucidated, and perhaps in some respects improved, the ideas of another (c).

81 Improvements of this edition.

The first edition of this essay, published 1752, having been favourably received by the world, and copies no longer to be found in the hands of booksellers, I have endeavoured to render this more perfect. The detail which I mean to give of my labour, will present the reader with a general idea of the principle of M. Rameau, of the consequences deduced from it, of the manner in which I have disposed this principle and its consequences; in short, of what is still a-wanting, and might be advantageous to the theory of this amiable art; of what still remains for the learned to contribute towards the perfection of this theory; of the rocks and quicksands which they ought to avoid in this research, and which could serve no other purpose than to retard their progress.

82 Account of the work in general.

83 Rameau's origin of harmony.

Every sonorous body, besides its principal sound, likewise exhibits to the ear the 12th and 17th major of that sound. This multiplicity of different yet concordant sounds, known for a considerable time, constitutes

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they were in possession of what we denominate *counterpoint*. Without supposing this, there are some passages in the Greek authors which can admit of no satisfactory interpretation. See the *Origin and Progress of Language*, Vol. II. Besides, we can discover some vestiges of harmony, however rude and imperfect, in the history of the Gothic ages, and amongst the most barbarous people. This they could not have derived from more cultivated countries, because it appears to be incorporated with their national music. The most rational account, therefore, which can be given, seems to be, that it was conveyed in a mechanical or traditionary manner through the Roman provinces from a more remote period of antiquity.

(c) See M. Rameau's letter upon this subject, *Merc. de Mai* 1752.

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tutes the basis of the whole theory of M. Rameau, and the foundation upon which he builds the whole superstructure of a musical system *. In these our *elements* may be seen, how from this experiment one may deduce, by an easy operation of reason, the chief points of melody and harmony; the perfect † chord, as well major as minor; the two ‡ tetrachords employed in ancient music; the formation of our diatonic || scale; the different values § which the same sound may have in that scale, according to the turn which is given to the bass *; the alterations ¶ which we observe in that scale, and the reason why they are totally imperceptible to the ear; the rules peculiar to the mode † major; the difficulty in ‡ intonation of forming three tones || in succession; the reason why two perfect chords are proscribed in immediate succession in the diatonic order; the origin of the minor mode, its subordination to the mode major, and its variations; the use of discord §; the causes of such effects as are produced by different kinds of music, whether diatonic, chromatic *, or enharmonic †; the principles and laws of temperament ‡. In this discourse we can only point out those different objects, the subsequent essay being designed to explain them with the minuteness and precision which they require.

* See *System*.
† See *Chord*.
‡ See *Tetrachord*.
|| See *Diatonic*.
§ See *Value*.
* See *Bass*.
¶ See *Alteration*.
† See *Mode*.
‡ See *Intonation*.
|| See *Tone*.
§ See *Discord*.
* See *Chromatic*.
† See *Enharmonic*.
‡ See *Temperament*.

One end which we have proposed in this treatise, was not only to place the discoveries of M. Rameau in their most conspicuous and advantageous light, but even in particular respects to render them more simple. —For instance, besides the fundamental experiment which we have mentioned above, that celebrated musician, to render the explication of some particular phenomena in music more accessible, had recourse to another experiment; I mean that which shows that a sonorous body struck and put in vibration, forces its 12th and 17th major in descending to divide themselves and produce a tremulous sound. The chief use which M. Rameau made of this second experiment was to investigate the origin of the minor mode, and to give a satisfactory account of some other rules established in harmony; and with respect to this in our first edition we have implicitly followed him: in this we have found means to deduce from the first experiment alone the formation of the minor mode, and besides to disengage that formation from all the questions which were foreign to it.

It is the same case with some other points (as the origin of the chord of the sub-dominant §, and the explication of the seventh in some peculiar respects), upon which it is imagined that we have simplified, and perhaps in some measure extended, the principles of the celebrated artist.

§ See *Subdominant*.

We have likewise banished from this edition, as from the former, every consideration of geometrical, arithmetical, and harmonical proportions and progressions, which authors have endeavoured to find in the mixture and protraction of tones produced by a sonorous body; persuaded as we are, that M. Rameau was under no necessity of paying the least regard to these proportions, which we believe to be not only useless, but even, if we may venture to say so, fallacious when applied to the theory of music. In short, though the relations produced by the octave, the fifth, and the third, &c. were quite different from what they are; though in these chords we should neither remark any progression nor any law; though they should be incommensurable one with another; the protracted tone of a sonorous body, and the multiplied sounds which result from it, are a sufficient foundation for the whole harmonic system.

84
Theoretical musicians cautioned with regard to the admission of mathematical or metaphysical principles in music.

But though this work is intended to explain the theory of music, and to reduce it to a system more complete and more luminous than has hitherto been done, we ought to caution those who shall read this treatise, that they may be careful not to deceive themselves, either by misapprehending the nature of our object, or the end which our endeavours pursue.

We must not here look for that striking evidence which is peculiar to geometrical discoveries alone, and which can be so rarely obtained in these mixed disquisitions, where natural philosophy is likewise concerned: into the theory of musical phenomena there must always enter a particular kind of metaphysics, which these phenomena implicitly take for granted, and which brings along with it its natural obscurity. In this subject, therefore, it would be absurd to expect what is called *demonstration*: it is an atchievement of no small importance, to have reduced the principal facts to a system consistent with itself, and firmly connected in its parts; to have deduced them from one simple experiment; and to have established upon this foundation the most common and essential rules of the musical art. But in another view, if here it be improper to require that intimate and unalterable conviction which can only be produced by the strongest evidence, we remain in the mean time doubtful whether it is possible to elucidate this subject more strongly.

After this declaration, one should not be astonished, that, amongst the facts which are deduced from our fundamental experiment, there should be some which appear immediately to depend upon that experiment, and others which are deduced from it in a way more remote and less direct. In disquisitions of natural philosophy, where we are scarcely allowed to use any other arguments, except such as arise from analogy or congruity, it is natural that the analogy should be sometimes more sometimes less sensible: and we will venture to assert, that such a mind must be very improper for philosophy, which cannot recognise and distinguish this gradation and the different circumstances on which it proceeds. It is not even surprising, that in a subject where analogy alone can take place, this conductress should desert us all at once in our attempts to account for certain phenomena. This likewise happens in the subject which we now treat; nor do we conceal the fact, however mortifying, that there are certain points (though their number be but small) which appear still in some degree unaccountable from our principle. Such, for instance, is the procedure of the diatonic scale in descending; the formation of the chord commonly termed the *sixth redundant* * or *superfluous*, and some other facts of less importance, for which as yet we can scarcely offer any satisfactory account except from experience alone.

* See *Redundant*.

Thus, though the greatest number of the phenomena in the art of music appear to be deducible in a simple and easy manner from the protracted tone of sonorous bodies, one ought not perhaps with too much temerity to affirm as yet, that this mixed and protracted tone is *demonstratively* the only original principle

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85 Rameau's primary experiment has not as yet accounted for all the phenomena of music. Perhaps some other may be necessary.

of harmony (D). But in the mean time it would not be lefs unjuft to reject this principle, becaufe certain phenomena appear to be deduced from it with lefs fuccefs than others. It is only neceffary to conclude from this, either that by future fcrutinies means may be found for reducing thefe phenomena to this principle; or that harmony has perhaps fome other unknown principle, more general than that which refults from the protracted and compounded tone of fonorous bodies, and of which this is only a branch; or, laftly, that we ought not perhaps to attempt the reduction of the whole fcience of mufic to one and the fame principle; which, however, is the natural effect of an impatience fo frequent even among philofophers themfelves, which induces them to take a part for the whole, and to judge of objects in their full extent by the greateft number of their appearances.

In thofe fciences which are called *phyfico-mathematical* (and amongft this number perhaps the fcience of founds may be placed), there are fome phenomena which depend only upon one fingle principle and one fingle experiment: there are others which neceffarily fuppofe a greater number both of experiments and principles, whofe combination is indifpenfable in forming an exact and complete fyftem; and mufic perhaps is in this laft cafe. It is for this reafon, that, whilft we beftow on M. Rameau all due praife, we fhould not at the fame time neglect to ftimulate the learned in their endeavours to carry them ftill to higher degrees of perfection, by adding, if it is poffible, fuch improvements as may be wanting to confummate the fcience.

Whatever the refult of their efforts may be, the reputation of this intelligent artift has nothing to fear: he will ftill have the advantage of being the firft who rendered mufic a fcience worthy of philofophical attention; to have made its practice more fimple and eafy; and to have taught muficians to employ in this fubject the light of reafon and analogy.

We would the more willingly perfuade thofe who are fkilled in theory and eminent in practice to extend and improve the views of him who before them purfued and pointed out the career, becaufe many amongft them have already made laudable attempts, and have even been in fome meafure fuccefsful in diffufing new light through the theory of this enchanting art. It was with this view that the celebrated Tartini has prefented us in 1754 with a treatife of harmony, founded on a principle different from that of M. Rameau. This principle is the refult of a moft beautiful experiment (†). If at once two different founds are produced from two inftruments of the fame kind, thefe two founds 86

86 Tartini's experiment.

(D) The *demonftration* of the principles of harmony by M. Rameau was not thus intitled in the expofition which he prefented in the year 1749 to the Academy of Sciences, and which that Society befides approved with all the eulogiums which the author deferved; the title, as inferted in the regifter of the academy, was, "A memorial, in which are explained the foundations of a fyftem of mufic theoretical and practical." It is likewife under this title that it was announced and approved of by the Commiffioners, who in their printed report, which the public may read along with M. Rameau's memorial, have never dignified his theory with any other name than that of a *fyftem*, the only name in reality which is expreffive of its nature. M. Rameau, who, after the approbation of the Academy, has thought himfelf at liberty to adorn his fyftem with the name of a *demonftration*, did not certainly recollect what the Academy has frequently declared; that, in approving any work, it was by no means implied, that the principles of that work appeared to them demonftrated. In fhort, M. Rameau himfelf, in fome writings pofterior to what he calls his *demonftration*, acknowledges, that upon particular points in the theory of the mufical art, he is under a neceffity of having recourfe to analogy and aptitude; this excludes every idea of demonftration, and reftores the theory of the mufical art exhibited by M. Rameau to the clafs in which it can only be ranked with propriety, I mean the clafs of probabilities.

(†) Had the utility of the preliminary difcourfe in which we are now engaged been lefs important and obvious than it really is, we fhould not have given ourfelves the trouble of tranflating, nor our readers that of perufing it. But it muft be evident to every one, that the cautions here given, and the advices offered, are no lefs applicable to ftudents than to authors. The firft queftion here decided is, Whether pure mathematics can be fuccefsfully applied to the theory of mufic? The author is juftly of a contrary opinion. It may certainly be doubted with great juftice, whether the folid contents of fonorous bodies, and their degrees of cohefion or elafticity, can be afcertained with fufficient accuracy to render them the fubjects of mufical fpeculation, and to determine their effects with fuch precifion as may render the conclufions deduced from them geometrically true. It is admitted, that found is a fecondary quality of matter, and that fecondary qualities have no obvious connection which we can trace with the fenfations produced by them. Experience, therefore, and not fpeculation, is the grand criterion of mufical phenomena. For the effects of geometry in illuftrating the theory of mufic (if any will ftill be fo credulous as to pay them much attention), the Englifh reader may confult Smith's Harmonics, Malcom's Differtation on Mufic, and Pleydel's Treatife on the fame fubject inferted in a former edition of this work. Our author next treats of the famous difcovery made by Sig. Tartini, of which the reader may accept the following compendious account.

If two founds be produced at the fame time properly tuned and with due force, from their conjunction a third found is generated, fo much more diftinctly to be perceived by delicate ears as the relation between the generating founds is more fimple; yet from this rule we muft except the unifon and octave. From the fifth is produced a found unifon with its loweft generator; from the fourth, one which is an octave lower than the higheft of its generators; from the third major, one which is an octave lower than its loweft; and from the fixth

founds generate * a third different from both the others. They have inserted in the *Encyclopédie*, under the article *Fundamental*, a detail of this experiment according to M. Tartini; and we owe to the public an information of which in compofing this article we were ignorant: M. Rameau, a member of the Royal Society at Montpellier, had prefented to that fociety in the year 1753, before the work of M. Tartini had appeared, a memorial printed the fame year, and where may be found the fame experiment difplayed at full length. In relating this fact, which it was neceffary for us to do, it is by no means our intention to detract in any degree from the reputation of M. Tartini; we are perfuaded that he owes this difcovery to his own refearches alone: but we think ourfelves obliged in honour to give public teftimony in favour of him who was the firft in exhibiting this difcovery.

* See *Generate*.

87 Its difcovery originally due to Rameau.

But whatever be the cafe, it is in this experiment that M. Tartini attempts to find the origin of harmony: his book, however, is written in a manner fo obfcure, that it is impoffible for us to form any judgement of it; and we are told that others diftinguifhed for their knowledge of the fcience are of the fame opinion. It were to be wifhed that the author would engage fome man of letters, equally practifed in mufic and fkilled in the art of writing, to unfold thefe ideas which he has not difcovered with fufficient perfpicuity, and from whence the art might perhaps derive confiderable advantage if they were placed in a proper light. Of this I am fo much the more perfuaded, that even though this experiment fhould not be regarded by others in the fame view with M. Tartini as the foundation of the mufical art, it is neverthelefs extremely probable that one might ufe it with the greateft advantage to enlighten and facilitate the practice of harmony.

In exhorting philofophers and artifts to make new attempts for the advancement of the theory of mufic, we ought at the fame time to let them know the danger of miftaking what is the real end of their refearches. Experience is the only foundation upon which they can proceed; it is alone by the obfervation of facts, by bringing them together in one view, by fhowing their dependency upon one, if poffible, or at leaft upon a very fmall number of primary facts,

that they can reach the end to which they fo ardently afpire, the important end of eftablifhing an exact theory of mufic, where nothing is wanting, nothing obfcure, but every thing difcovered in its full extent, and in its proper light. The philofopher who is properly enlightened, will not give himfelf the trouble to explain fuch facts as are lefs effential to his art, becaufe he can difcern thofe on which he ought to expatiate for its proper illuftration. If one would eftimate them according to their proper value, he will only find it neceffary to caft his eyes upon the attempts of natural philofophers who have difcovered the greateft fkill in their fcience; to explain, for inftance, the multiplicity of tones produced by fonorous bodies. Thefe fages, after having remarked (what is by no means difficult to conclude) that the univerfal vibration of a mufical ftring is a mixture of feveral partial vibrations, from thence infer, that a fonorous body ought to produce a multiplicity of tones, as it really does. But why fhould this multiplied found only appear to contain three, and why thefe three preferable to others? Some pretend that there are particles in the air, which, by their different degrees of magnitude and texture, being naturally fufceptible of different ofcillations, produce the multiplicity of found in queftion. But what do we know of all this hypothetical doctrine? And though it fhould even be granted, that there is fuch a diverfity of tenfion in thefe aerial particles, how fhould this diverfity prevent them from being all of them confounded in their vibrations by the motions of a fonorous body? What then fhould be the refult, when the vibrations arrive at our ears, but a confufed and inappretiable† noife, where one could not diftinguifh any particular found?

88 Mechanical conclufions inadequate to the fituation of mufical phenomena.

† See *Inappretiable*.

If philofophical muficians ought not to lofe their time in fearching for mechanical explications of the phenomena in mufic, explications which will always be found vague and unfatisfactory; much lefs is it their province to exhauft their powers in vain attempts to rife above their fphere into a region ftill more remote from the profpect of their faculties, and to lofe themfelves in a labyrinth of metaphyfical fpeculations upon the caufes of that pleafure which we feel from harmony. In vain would they accumulate hypothefis on hypothefis, to find a reafon why fome chords fhould pleafe us

89 Metaphyfical conclufions lefs adequate.

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fixth minor (whofe higheft note forms an octave with the loweft in the third formerly mentioned) will be produced a found lower by a double octave than the higheft of the leffer fixth; from the third minor, one which is double the diftance of a greater third from its loweft; but from the fixth major (whofe higheft note makes an octave to the loweft in the third minor) will be produced a found only lower by double the quantity of a greater third than the higheft; from the fecond major, a found lower by a double octave than the loweft; from a fecond minor, a found lower by triple the quantity of a third major than the higheft; from the interval of a diatonic or greater femitone, a found lower by a triple octave than the higheft; from that of a minor or chromatic femitone, a found lower by the quantity of a fifth four times multiplied than the loweft, &c. &c. But that thefe mufical phenomena may be tried by experiments proper to afcertain them, two hautboys tuned with fcrupulous exactnefs muft be procured, whilft the muficians are placed at the diftance of fome paces one from the other, and the hearers in the middle. The violin will likewife give the fame chords, but they will be lefs diftinctly perceived, and the experiment more fallacious, becaufe the vibrations of other ftrings may be fuppofed to enter into it.

If our Englifh reader fhould be curious to examine thefe experiments and the deductions made from them in the theory of mufic, he will find them clearly explained and illuftrated in a treatife called *Principles and Power of Harmony*, printed at London in the year 1771.

Prelim. Difcourfe.

us more than others. The futility of thefe fuppofititious accounts muft be obvious to every one who has the leaft penetration. Let us judge of the reft by the moft probable which has till now been invented for that purpofe. Some afcribe the different degrees of pleafure which we feel from chords, to the more or lefs frequent coincidence of vibrations; others to the relations which thefe vibrations have among themfelves as they are more or lefs fimple. But why fhould this coincidence of vibrations, that is to fay, their fimultaneous impulfe on the fame organs of fenfation, and the accident of beginning frequently at the fame time, prove fo great a fource of pleafure? Upon what is this gratuitous fuppofition founded? And though one fhould grant it, would it not follow from thence, that the fame chord fhould fucceffively and rapidly affect us with contrary fenfations, fince the vibrations are alternately coincident and difcrepant? On the other hand, how fhould the ear be fo fenfible to the fimplicity of relations, whilft for the moft part thefe relations are entirely unknown to him whofe organs are notwithftanding fenfibly affected with the charms of agreeable mufic? We may conceive without difficulty how the eye judges of relations; but how does the ear form fimilar judgments? Befides, why fhould certain chords which are extremely pleafing in themfelves, fuch as the fifth, lofe almoft nothing of the pleafure which they give us, when they are altered, and of confequence when the fimplicity of their relations are deftroyed; whilft other chords, which are likewife extremely agreeable, fuch as the third, become harfh almoft by the fmalleft alteration; nay, whilft the moft perfect and the moft agreeable of all chords, I mean the octave, cannot fuffer the moft inconfiderable change? Let us in fincerity confefs our ignorance concerning the genuine caufes of thefe effects (†). The metaphyfical conjectures concerning the accouftic organs are probably in the fame predicament with thofe which are formed concerning the organs of vifion, if one may fpeak fo, in which philofophers have even till now made fuch inconfiderable progrefs, and in all likelihood will not be furpaffed by their fucceffors.

Since the theory of mufic, even to thofe who confine themfelves within its limits, implies queftions from which every wife mufician will abftain, with much greater reafon fhould they avoid idle excurfions beyond the boundaries of that theory, and endeavours to inveftigate between mufic and the other fciences chimerical relations which have no foundation in nature. The fingular opinions advanced upon this fubject by fome even of the moft celebrated muficians, deferve not to be refcued from oblivion, nor refuted; and ought only to be regarded as a new proof how far men of genius may deviate from truth and tafte, when they engage in fubjects of which they are ignorant.

The rules which we have attempted to eftablifh concerning the track which every one ought to purfue in the theory of the mufical art, may fuffice to fhow our readers the end which we have propofed, and which we have endeavoured to attain in this Work. We have nothing to do here (for it is proper that we repeat it), we have nothing to do with the mechanical principles of protracted and harmonic tones produced by fonorous bodies; principles which till now have been explored in vain, and which perhaps may be long explored with the fame fuccefs; we have ftill lefs

(†) We have as great an averfion as our author to the explication of mufical phenomena from mechanical principles; yet we fear the following obfervations, deduced from irrefiftible and univerfal experience, evidently fhow that the latter neceffarily depend on the former. It is, for inftance, univerfally allowed, that diffonances grate and concords pleafe a mufical ear: It is likewife no lefs unanimoufly agreed, that in proportion as a chord is perfect, the pleafure is increafed; now the perfection of a chord confifts in the regularity and frequency of coincident ofcillations between two fonorous bodies impelled to vibrate: thus the third is a chord lefs perfect than the fifth, and the fifth than the octave. Of all thefe confonances, therefore, the octave is moft pleafing to the ear; the fifth next, and the third laft. In abfolute difcords, the vibrations are never coincident, and of confequence a perpetual pulfation or jarring is recognifed between the protracted founds, which exceedingly hurts the ear; but in proportion as the vibrations coincide, thofe pulfations are fuperfeded, and a kindred formed betwixt the two continued founds, which delights even the corporeal fenfe: that relation, therefore, without recognifing the aptitudes which produce it, muft be the obvious caufe of the pleafure which chords give to the ear. What we mean by coincident vibrations is, that while one fonorous body performs a given number of vibrations, another performs a different number in the fame time; fo that the vibrations of the quickeft muft fometimes be fimultaneous with thofe of the floweft, as will plainly appear from the following deduction: Between the extremes of a third, the vibrations of the higheft are as 5 to 4 of the loweft; thofe of the fifth as 3 to 2; thofe of the octave as 2 to 1. Thus it is obvious, that in proportion to the frequent coincidence of periodical vibrations, the compound fenfation is more agreeable to the ear. Now, to inquire why that organ fhould be rather pleafed with thefe than with the pulfation and tremulous motion of encountering vibrations which can never coalefce, would be to afk why the touch is rather pleafed with polifhed than rough furfaces? or, why the eye is rather pleafed with the waving line of Hogarth than with fharp angles and abrupt or irregular prominences? No alteration of which any chord is fufceptible will hurt the ear unlefs it fhould violate or deftroy the regular and periodical coincidence of vibrations. When alterations can be made without this difagreeable effect, they form a pleafing diverfity; but ftill this fact corroborates our argument, that in proportion as any chord is perfect, it is impatient of the fmalleft alteration; for this reafon, even in temperament, the octave endures no alteration at all, and the fifth as little as poffible.

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lefs to do with the metaphyfical caufes of thofe pleafing fenfations which are impreffed on the mind by harmony; caufes which are ftill lefs difcovered, and which, according to all appearances, will remain latent in perpetual obfcurity. We are alone concerned to fhow how the chief and moft effential laws of harmony may be deduced from one fingle experiment; and for which, if we may fpeak fo, preceding artifts have been under a neceffity of groping in the dark.

With an intention to render this work as generally ufeful as poffible, I have endeavoured to adapt it to the capacity even of thofe who are abfolutely uninftructed in mufic. To accomplifh this defign, it appeared neceffary to purfue the following plan.

90 Plan of the treatife.

To begin with a fhort introduction, in which are defined the technical terms moft frequently ufed in this art; fuch as *chord*, *harmony*, *key*, *third*, *fifth*, *octave*, &c.

Afterwards to enter into the theory of harmony, which is explained according to M. Rameau, with all poffible perfpicuity. This is the fubject of the *Firft Part;* which, as well as the introduction, prefuppofes no other knowledge of mufic than that of the names and powers of the fyllables, *ut*, *re*, *mi*, *fa*, *fol*, *la*, *fi*, or C, D, E, F, G, A, B, which all the world knows (†).

The theory of harmony requires fome arithmetical calculations, which are neceffary for comparing founds one with another. Thefe calculations are very fhort, extremely fimple, and conducted in fuch a manner as to be fenfibly comprehended by every one; they demand no operation but what is clearly explained, and which every fchool-boy with the flighteft attention may perform. Yet, that even the trouble of this may be fpared to fuch as are not difpofed to take it, I have not inferted thefe calculations in the body of the treatife, but transferred them to the notes, which the reader may omit, if he can fatisfy himfelf by taking for granted the propofitions contained in the work, which will be found proved in the notes.

Thefe calculations I have not endeavoured to multiply; I could even have wifhed to fupprefs them, if it had been poffible: fo much did it appear to me to be apprehended that my readers might be mifled upon this fubject, and might either believe themfelves, or at leaft fufpect me of believing, all this arithmetic neceffary to form an artift. Calculations may indeed facilitate the underftanding of certain points in the theory, as of the relations between the different notes in the gammut and of the temperament; but the calculations neceffary for treating of thefe points are fo fimple, and, to fpeak more properly, of fo little importance, that nothing can require a lefs minute or oftentatious difplay. Do not let us imitate thofe muficians who, believing themfelves geometers, or thofe geometers who, believing themfelves muficians, fill their writings with figures upon figures; imagining, perhaps, that this apparatus is neceffary to the art. The propenfity of adorning their works with a falfe air of fcience, can only impofe upon credulity and ignorance, and ferve no other purpofe but to render their treatifes more obfcure and lefs inftructive. In the character of a geometer, I think I have fome right to proteft here (if I may be permitted to exprefs myfelf in this manner) againft fuch ridiculous abufe of geometry in mufic.

91 Mathematical conclufions not transferable to fenfible objects without caution.

This I may do with fo much more reafon, that in this fubject the foundations of thofe calculations are in fome manner hypothetical, and can never arife to a degree of certainty above hypothefis. The relation of the octave as 1 to 2, that of the fifth as 2 to 3, that of the third major as 4 to 5, &c. are not perhaps the genuine relations eftablifhed in nature; but only relations which approach them, and fuch as experience can difcover. For are the refults of experience any thing more but mere approaches to truth?

But happily thefe approximated relations are fufficient, though they fhould not be exactly agreeable to truth, for giving a fatisfactory account of thofe phenomena which depend on the relations of found; as in the difference between the notes in the gammut, of the alterations neceffary in the fifth and third, of the different manner in which inftruments are tuned, and other facts of the fame kind. If the relations of the octave, of the fifth, and of the third, are not exactly fuch as we have fuppofed them, at leaft no experiments can prove that they are not fo; and fince thefe relations are fignified by a fimple expreffion, fince they are befides fufficient for all the purpofes of theory, it would not only be ufelefs, but even contrary to found philofophy, fhould any one incline to invent other relations, to form the bafis of any fyftem of mufic lefs eafy and fimple than that which we have delineated in this treatife.

The *fecond part* contains the moft effential rules of compofition *, or in other words the practice of harmony. Thefe rules are founded on the principles laid down in the *firft part;* yet thofe who wifh to underftand no more than is neceffary for practice, without exploring the reafons why fuch practical rules are neceffary, may limit the objects of their ftudy to the *introduction* and the *fecond part*. They who have read the *firft part*, will find at every rule contained in the *fecond*, a reference to that paffage in the

* See *Compofition*.

(†) The names of the feven notes ufed by the French are here retained, and will indeed be continued through the whole enfuing work; as we imagine, that, if properly affociated with the founds which they denominate, they will tend to imprefs thefe founds more diftinctly on the memory of the fcholar than the letters C, D, E, F, G, A, B, from which characters, except in fol-fa'ing, the notes in the diatonic feries are generally named in Britain. Amongft us, in the progrefs of intonation, the fyllables *ut*, *re*, and *fi*, have been omitted, by which means the teachers of church-mufic have rendered it ftill more difficult to exprefs by the four remaining denominations the various changes of the femitones in the octave. As thefe artificially change their places, the feven fyllables above mentioned alfo diverfify their powers, and are varioufly arranged according to the intervals in which the notes they are intended to fignify may be placed.

For an account of thefe variations, fee Rouffeau's Mufical Dictionary, article GAMME. See alfo the Effay towards a Rational Syftem of Mufic, by John Holden, part i. chap. 1.

the *firſt* where the reaſons for eſtabliſhing that rule are given.

92 ne rules, account their icacy, nsferred the notes. That we may not preſent at once too great a number of objects and precepts, I have transferred to the notes in the ſecond part ſeveral rules and obſervations which are leſs frequently put in practice, which perhaps it may be proper to omit till the treatiſe is read a ſecond time, when the reader is well acquainted with the eſſential and fundamental rules explained in it.

This ſecond part, ſtrictly ſpeaking, preſuppoſes, no more than the firſt, any habit of ſinging, nor even any knowledge of muſic; it only requires that one ſhould know, not even the rules and manner of intonation, but merely the poſition of the notes in the cleff *fa* or F on the fourth line, and that of *ſol* or G upon the ſecond: and even this knowledge may be acquired from the work itſelf; for in the beginning of the ſecond part I explain the poſitions of the cleffs and of the notes. Nothing elſe is neceſſary but to render it a little familiar to our memory, and we ſhall have no more difficulty in it.

93 l the es of muſi- n not to expected an ele- ntary ay. It would be wrong to expect here all the rules of compoſition, and eſpecially thoſe which direct the compoſition of muſic in ſeveral parts, and which, being leſs ſevere and indiſpenſable, may be chiefly acquired by practice, by ſtudying the moſt approved models, by the aſſiſtance of a proper maſter, but above all by the cultivation of the ear and of the taſte. This treatiſe is properly nothing elſe, if I may be allowed the expreſſion, but the rudiments of muſic, intended for explaining to beginners the fundamental principles, not the practical detail of compoſition. Thoſe who wiſh to enter more deeply into this detail, will either find it in Mr Rameau's treatiſe of harmony, or in the code of muſic which he publiſhed more lately (I), or laſtly in the explication of the theory and practice of muſic by M. Bethizi (K): this laſt book appears to me clear and methodical.

One may look upon it (with reſpect to a practical detail) as a ſupplement to my own performance. I do this juſtice to the author with ſo much more cheerfulneſs, as he is entirely unknown to me, and as his animadverſions upon my work appear to me leſs ſevere than it deſerved (L).

94 ture the ntial ſtreſs of ſical mpoſi- n. Is it neceſſary to add, that, in order to compoſe muſic in a proper taſte, it is by no means enough to have familiarized with much application the principles explained in this treatiſe? Here can only be learned the mechaniſm of the art; it is the province of nature alone to accompliſh the reſt. Without her aſſiſtance, it is no more poſſible to compoſe agreeable muſic by having read theſe elements, than to write verſes in a proper manner with the Dictionary of Richelet. In one word, it is the elements of muſic alone, and not the principles of genius, that the reader may expect to find in this treatiſe.

Such was the aim I purſued in its compoſition, and ſuch ſhould be the ideas of the reader in its peruſal. Once more let me add, that to the diſcovery of its fundamental principles I have not the remoteſt claim. The ſole end which I propoſed was to be uſeful; to reach that end, I have omitted nothing which appeared neceſſary, and I ſhould be ſorry to find my endeavours unſucceſsful.

DEFINITIONS OF SEVERAL TECHNICAL TERMS.

I. *What is meant by Melody, by Chord, by Harmony, by Interval.*

1. Melody is nothing elſe but a ſeries of ſounds which ſucceed one to another in a manner agreeable to the ear. 95 Melody, what.

2. That is called a *chord* which ariſes from the mixture of ſeveral ſounds heard at the ſame time; and harmony is properly a ſeries of chords which in their ſucceſſion one to another delights the ear. A ſingle chord is likewiſe ſometimes called *harmony*, to ſignify the coaleſcence of ſounds which that chord creates, and the ſenſation produced in the ear by that coaleſcence. We ſhall occaſionally uſe the word *harmony* in this laſt ſenſe; but in ſuch a manner as never to leave our meaning ambiguous. 96 Chord and harmony, what.

3. In melody and harmony, the diſtance between one ſound and another is called an *interval*; and this is increaſed or diminiſhed as the ſounds between which it intervenes are higher or lower one than the other. See *Interval.*

4. That we may learn to diſtinguiſh the intervals, and the manner of perceiving them, let us take the ordinary ſcale *ut, re, mi, fa, ſol, la, ſi, UT,* C, D, E, F, G, A, B, C, which every perſon whoſe ear or voice is not extremely falſe naturally modulates. Theſe are the obſervations which will occur to us in ſinging this gammut.

The ſound *re* is higher or ſharper than the ſound *ut*, the ſound *mi* higher than the ſound *re*, the ſound *fa* higher than the ſound *mi*, &c. and ſo through the whole octave; ſo that the interval or the diſtance from the ſound *ut* to the ſound *re*, is leſs than the interval or diſtance between the ſound *ut* and the ſound *mi*, the interval from *ut* to *mi* is leſs than that between *ut* and *fa*, &c. and in ſhort that the interval from the firſt to the ſecond *ut* is the greateſt of all.—To diſtinguiſh the firſt from the ſecond *ut*, I have marked the laſt with capital letters. 97 Account of the ſimple intervals.

5. In general, the interval between two ſounds is proportionably greater, as one of theſe ſounds is higher or lower with relation to the other: but it is neceſſary to obſerve, that two ſounds may be equally high or low, though unequal in their force. The ſtring of a violin touched with a bow produces always a ſound equally high, whether ſtrongly or faintly ſtruck; the ſound will only have a greater or leſſer degree of ſtrength. It is the ſame with vocal modulation; 98 The diſtinction between ſtrong and faint, or acute and grave.

(I) From my general recommendation of this code, I except the reflections on the principles of ſound which are at the end, and which I ſhould not adviſe any one to read.

(K) Printed at Paris by Lambert in the year 1754.

(L) That criticiſm and my anſwers may be ſeen in the *Journeaux Economiques* of 1752.

Definitions. lation; let any one form a ſound by gradually impelling or ſwelling the voice, the ſound may be perceived to increaſe in its energy, whilſt it continues always equally low or equally high.

99 Between tonic and ſemitonic intervals.

6. We muſt likewiſe obſerve concerning the ſcale, that the intervals between *ut* and *re*, between *re* and *mi*, between *fa* and *ſol*, between *ſol* and *la*, between *la* and *ſi*, are equal, or at leaſt nearly equal; and that the intervals between *mi* and *fa*, and between *ſi* and *ut*, are likewiſe equal among themſelves, but conſiſt almoſt only of half the former. This fact is known and recogniſed by every one: the reaſon for it ſhall be given in the ſequel; in the mean time every one may aſcertain its reality by the aſſiſtance of an experiment (A).

7. It is for this reaſon that they have called the interval from *mi* to *fa*, and from *ſi* to *ut*, a ſemitone; whereas thoſe between *ut* and *re*, *re* and *mi*, *fa* and *ſol*, *ſol* and *la*, *la* and *ſi*, are tones.

The *tone* is likewiſe called a *ſecond major* *, and the *ſemitone* a *ſecond minor* †.

* See the figure marked A.
† See *Interval*.

8. To deſcend or riſe diatonically, is to deſcend or riſe from one ſound to another by the interval of a tone or of a ſemitone, or in general by ſeconds, whether major or minor; as from *re* to *ut*, or from *ut* to *re*, from *fa* to *mi*, or from *mi* to *fa*.

II. *The Terms by which the different Intervals of the Gammut are denominated.*

Definitions

9. An interval compoſed of a tone and a ſemitone, as from *mi* to *ſol*, from *la* to *ut*, or from *re* to *fa*, is called a *third minor*. 100 Third minor, what

An interval compoſed of two full tones, as from *ut* to *mi*, from *fa* to *la*, or from *ſol* to *ſi*, is called a *third major*. 101 Third major, what

An interval compoſed of two tones and a ſemitone, as from *ut* to *fa*, or from *ſol* to *ut*, is called a *fourth*. 102 Fourth, what.

An interval conſiſting of three full tones, as from *fa* to *ſi*, is called a *triton* or *fourth redundant*. 103 Triton, what.

An interval conſiſting of three tones and a ſemitone, as from *ut* to *ſol*, from *fa* to *ut*, from *re* to *la*, or from *mi* to *ſi*, &c. is called a *fifth*. 104 Fifth, what

An interval compoſed of three tones and two ſemitones, as from *mi* to *ut*, is called a *ſixth minor*. 105 Sixth minor, what

An interval compoſed of four tones and a ſemitone, as from *ut* to *la*, is called a *ſixth major*. 106 Sixth major, what

An interval conſiſting of four tones and two ſemitones, as from *re* to *ut*, is called a *ſeventh minor*. 107 Seventh minor, what

An interval compoſed of five tones and a ſemitone, as from *ut* to *ſi*, is called a *ſeventh major*. 108 Seventh major, And what.

(A) This experiment may be eaſily tried. Let any one ſing the ſcale of *ut, re, mi, fa, ſol, la, ſi, UT,* / C, D, E, F, G, A, B, C, it will be immediately obſerved without difficulty, that the laſt four notes of the octave *ſol, la, ſi, UT,* / G, A, B, C, are quite ſimilar to the firſt *ut, re, mi, fa*; inſomuch, that if, after having ſung this ſcale, one would chooſe to repeat it, beginning with *ut* in the ſame tone which was occupied by *ſol* in the former ſcale, the note *re* of the laſt ſcale would have the ſame ſound with the note *la* in the firſt, the *mi* with the *ſi*, and the *fa* with the *ut*.

From whence it follows, that the interval between *ut* and *re*, is the ſame as between *ſol* and *la*; between *re* and *mi*, as between *la* and *ſi*; and *mi* and *fa*, as between *ſi* and *ut*.

It will likewiſe be found, that from *re* to *mi*, from *fa* to *ſol*, there is the ſame interval as from *ut* to *re*. To be convinced of this, we need only ſing the ſcale once more; then ſing it again, beginning with *ut*, in this laſt ſcale, in the ſame tone which was given to *re* in the firſt; and it will be perceived, that the *re* in the ſecond ſcale will have the ſame ſound, at leaſt as far as the ear can diſcover, with the *mi* in the former ſcale; from whence it follows, that the difference between *re* and *mi* is, at leaſt as far as the ear can perceive, equal to that between *ut* and *re*. It will alſo be found, that the interval between *fa* and *ſol* is, ſo far as our ſenſe can determine, the ſame with that between *ut* and *re*.

This experiment may perhaps be tried with ſome difficulty by thoſe who are not inured to form the notes and change the key; but ſuch may very eaſily perform it by the aſſiſtance of a harpſichord, by means of which the performer will be ſaved the trouble of retaining the ſounds in one intonation whilſt he performs another. In touching upon this harpſichord the keys *ſol, la, ſi, ut*, and in performing with the voice at the ſame time *ut, re, mi, fa*, in ſuch a manner that the ſame ſound may be given to *ut* in the voice with that of the key *ſol* in the harpſichord, it will be found that *re* in the vocal intonation ſhall be the ſame with *la* upon the harpſichord, &c.

It will be found likewiſe by the ſame harpſichord, that if one ſhould ſing the ſcale beginning with *ut* in the ſame tone with *mi* on the inſtrument, the *re* which ought to have followed *ut*, will be higher by an extremely perceptible degree than the *fa* which follows *mi*: thus it may be concluded, that the interval between *mi* and *fa* is leſs than between *ut* and *re*; and if one would riſe from *fa* to another ſound which is at the ſame diſtance from *fa* as *fa* from *mi*, he would find in the ſame manner, that the interval from *mi* to this new ſound is almoſt the ſame as that between *ut* and *re*. The interval then from *mi* to *fa* is nearly half of that between *ut* and *re*.

Since then, in the ſcale thus divided, *ut, re, mi, fa,* / *ſol, la, ſi, Ut,* the firſt diviſion is perfectly like the laſt; and ſince the intervals between *ut* and *re*, between *re* and *mi*, and between *fa* and *ſol*, are equal; it follows, that the intervals between *ſol* and *la*, and between *la* and *ſi*, are likewiſe equal to every one of the three intervals between *ut* and *re*, between *re mi*, and between *fa* and *ſol*; and that the intervals between *mi* and *fa* and between *ſi* and *ut* are alſo equal, but that they only conſtitute one half of the others.

Definitions.

109 Octave, what. And in short, an interval consisting of five tones and two semitones, as from *ut* to *UT*, is called an *octave*.

A great many of the intervals which have now been mentioned, are still signified by other names, as may be seen in the beginning of the second part; but those which we have now given are the most common, and the only terms which our present purpose demands.

110 Unison, what. 10. Two sounds equally high, or equally low, however unequal in their force, are said to be in *unison* one with the other.

11. If two sounds form between them any interval, whatever it be, we say, that the highest when ascending is in that interval with relation to the lowest; and when descending, we pronounce the lowest in the same interval with relation to the highest. Thus in the third minor *mi, sol*, where *mi* is the lowest and *sol* the highest sound, *sol* is a third minor from *mi ascending*, and *mi* is third minor from *sol in descending*.

12. In the same manner, if, speaking of two sonorous bodies, we should say, that the one is a fifth above the other *in ascending*; this infers that the sound given by the one is at the distance of a fifth *ascending* from the sound given by the other.

III. *Of Intervals greater than the Octave.*

See fig. B. 13. If, after having sung the scale *ut, re, mi, fa, sol, la, si, UT*, one would carry this scale still farther in ascent, it would be discovered without difficulty that a new scale would be formed, UT, RE, MI, FA, &c. entirely similar to the former, and of which the sounds will be an octave ascending, each to its correspondent note in the former scale: thus RE, the second note of the second scale, will be an octave in ascent to the *re* of the first scale; in the same manner MI shall be the octave to *mi*, &c. and so of the rest.

111 Ninth, what. 14. As there are nine notes from the first *ut* to the second RE, the interval between these two sounds is called a *ninth*, and this ninth is composed of six full tones and two semitones. For the same reason the interval from *ut* to FA is called an *eleventh*, and the interval between *ut* and SOL, a *twelfth*, &c.

112 Eleventh and twelfth what. It is plain that the *ninth* is the octave of the *second*, the *eleventh* of the *fourth*, and the *twelfth* of the *fifth*, &c.

The octave above the octave of any sound is called a *double octave* §; the octave of the double octave is called a *triple octave*, and so of the rest.

§ See *Interval* and *Double Octave*.

The double octave is likewise called a *fifteenth*: and for the same reason the double octave of the third is called a *seventeenth*, the double octave of the fifth a *nineteenth*, &c. (B).

IV. *What is meant by Sharps and Flats.*

113 Sharps and flats, what. See *Interval*. 15. It is plain that one may imagine the five tones which enter into the scale, as divided each into two semitones; thus one may advance from *ut* to *re*, forming in his progress an intermediate sound, which shall be higher by a semitone than *ut*, and lower in the same degree than *re*. A sound in the scale is called *sharp*, when it is raised by a semitone; and it is marked with this character ※: thus *ut* ※ signifies *ut sharp*, that is to say, *ut* raised by a semitone above its pitch in the natural scale. A sound in the scale depressed by a semitone is called *flat*, and is marked thus, ♭: thus *la* ♭ signifies *la flat*, or *la* depressed by a semitone.

V. *What is meant by Consonances and Dissonances.*

114 Consonance, what. See *Chord*. 16. A chord composed of sounds whose union or coalescence pleases the ear is called a *consonance*; and the sounds which form this chord are said to be consonant

(B) Let us suppose two vocal strings formed of the same matter, of the same thickness, and equal in their tension, but unequal in their length, it will be found by experience.

1st, That if the shortest is equal to half the longest, the sound which it will produce must be an octave above the sound produced by the longest.

2dly, That if the shortest constitutes a third part of the longest, the sound which it produces must be a twelfth above the sound produced by the longest.

3dly, That if it constitutes the fifth part, its sound will be a seventeenth above.

Besides, it is a truth demonstrated and generally admitted, that in proportion as one musical string is less than another, the vibrations of the least will be more frequent (that is to say, its departures and returns through the same space) in the same time; for instance, in an hour, a minute, a second, &c. in such a manner that one string which constitutes a third part of another, forms three vibrations, whilst the largest has only accomplished one. In the same manner, a string which is one half less than another, performs two vibrations, whilst the other only completes one; and a string which is only the fifth part of another, will perform five vibrations in the same time which is occupied by the other in one.

From thence it follows, that the sound of a string is proportionally higher or lower, as the number of its vibrations is greater or smaller in a given time; for instance, in a second.

It is for that reason, that if we represent any sound whatever by 1, one may represent the octave above by 2, that is to say, by the number of vibrations formed by the string which produces the octave, whilst the longest string only vibrates once; in the same manner we may represent the twelfth above the sound 1 by 3, the seventeenth major above 5, &c. But it is very necessary to remark, that by these numerical expressions, we do not pretend to compare sounds as such; for sounds in themselves are nothing but mere sensations, and it cannot be said of any sensation that it is double or triple to another: thus the expressions 1, 2, 3, &c. employed to denominate a sound, its octave above, its twelfth above, &c. signify only, that if a string performs a certain number of vibrations, for instance, in a second, the string which is in the octave above shall double the number in the same time, the string which is in the twelfth above shall triple it, &c.

Thus to compare sounds among themselves is nothing else than to compare among themselves the numbers of vibrations which are formed in a given time by the strings that produce these sounds.

Definitions. nant one with relation to the other. The reason of this denomination is, that a chord is found more perfect, as the sounds which form it coalesce more closely among themselves.

17. The octave of a sound is the most perfect of consonances of which that sound is susceptible; then the fifth, afterwards the third, &c. This is a fact founded on experiment.

115 Dissonance, what. 18. A number of sounds simultaneously produced whose union is displeasing to the ear is called a *dissonance*, and the sounds which form it are said to be dissonant one with relation to the other. The second, the triton, and the seventh of a sound, are dissonants with relation to it. Thus the sounds *ut re*, *ut si*, or *fa si*, &c. simultaneously heard, form a dissonance. The reason which renders dissonance disagreeable, is, that the sounds which compose it, seem by no means coalescent to the ear, and are heard each of them by itself as distinct sounds, though produced at the same time. See *Discord*.

Part I. THEORY of HARMONY.

Chap I. *Preliminary and Fundamental Experiments.*

Experiment I.

19. WHEN a sonorous body is struck till it gives a sound, the ear, besides the principal sound and its octave, perceives two other sounds very high, of which one is the twelfth above the principal sound, that is to say, the octave to the fifth of that sound; and the other is the seventeenth major above the same sound, that is to say, the double octave of its third major.

20. This experiment is peculiarly sensible upon the thick strings of the violoncello, of which the sound being extremely low, gives to an ear, though not very much practised, an opportunity of distinguishing with sufficient ease and clearness the twelfth and seventeenth now in question (c).

21. The principal sound is called the *generator* *; and

* See *Generator*.

(c) Since the octave above the sound 1 is 2, the octave below that same sound shall be $\frac{1}{2}$; that is to say, that the string which produces this octave shall have performed half its vibration, whilst the string which produces the sound 1 shall have completed one. To obtain therefore the octave above any sound, the operator must multiply the quantity which expresses the sound by 2; and to obtain the octave below, he must on the contrary divide the same quantity by 2.

It is for that reason that if any sound whatever, for instance *ut*, is denominated	1
Its octave above will be	2
Its double octave above	4
Its triple octave above	8
In the same manner its octave below will be	$\frac{1}{2}$
Its double octave below	$\frac{1}{4}$
Its triple octave below	$\frac{1}{8}$
And so of the rest.	
Its twelfth above	3
Its twelfth below	$\frac{1}{3}$
Its 17th major above	5
Its 17th major below	$\frac{1}{5}$

The fifth then above the sound 1 being the octave beneath the twelfth, shall be, as we have immediately observed, $\frac{3}{2}$; which signifies that this string performs $\frac{3}{2}$ vibrations; that is to say, one vibration and a half during a single vibration of the string which gives the sound 1.

To obtain the fourth above the sound 1, we must take the twelfth below that sound, and the double octave above that twelfth. In effect, the twelfth below *ut*, for instance, is *fa*, of which the double octave *fa* is the fourth above *ut*. Since then the twelfth below 1 is $\frac{1}{3}$, it follows that the double octave above this twelfth, that is to say, the fourth from the sound 1 in ascending, will be $\frac{1}{3}$ multiplied by 4, or $\frac{4}{3}$.

In short, the third major being nothing else but the double octave beneath the seventeenth, it follows, that the third major above the sound 1 will be 5 divided by 4, or in other words $\frac{5}{4}$.

The third major of a sound, for instance the third major *mi*, from the sound *ut*, and its fifth *sol*, form between them a third minor *mi*, *sol*; now *mi* is $\frac{5}{4}$, and *sol* $\frac{3}{2}$, by what has been immediately demonstrated: from whence it follows, that the third minor, or the interval between *mi* and *sol*, shall be expressed by the relation of the fraction $\frac{5}{4}$ to the fraction $\frac{3}{2}$.

To determine this relation, it is necessary to remark, that $\frac{5}{4}$ are the same thing with $\frac{10}{8}$, and that $\frac{3}{2}$ are the same thing with $\frac{12}{8}$: so that $\frac{5}{4}$ shall be to $\frac{3}{2}$ in the same relation as $\frac{10}{8}$ to $\frac{12}{8}$; that is to say, in the same relation as 10 to 12, or as 5 to 6. If, then, two sounds form between themselves a third minor, and that the first is represented by 5, the second shall be expressed by 6; or, what is the same thing, if the first is represented by 1, the second shall be expressed by $\frac{6}{5}$.

Thus

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and the two other sounds which it produces, and with which it is accompanied, are, inclusive of its octave, called its *harmonics* §.

116 Generator, what. See *Harmonic.*

EXPERIMENT II.

22. There is no person insensible of the resemblance which subsists between any sound and its octave, whether above or below. These two sounds, when heard together, almost entirely coalesce in the organ of sensation. We may besides be convinced (by two facts which are extremely simple) of the facility with which one of these sounds may be taken for the other.

Let it be supposed that any person has an inclination to sing a tune, and having at first begun this air upon a pitch too high or too low for his voice, so that he is obliged, lest he should strain himself too much, to sing the tune in question on a key higher or lower than the first; I affirm, that, without being initiated in the art of music, he will naturally take his new key in the octave below or the octave above the first; and that in order to take this key in any other interval except the octave, he will find it necessary to exert a sensible degree of attention. This is a fact of which we may easily be persuaded by experience.

Another fact. Let any person sing a tune in our presence, and let it be sung in a tone too high or too low for our voice; if we wish to join in singing this air, we naturally take the octave below or above, and frequently, in taking this octave, we imagine it to be the unison (D).

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CHAP. II. *The Origin of the Modes Major and Minor; of the most natural Modulation, and the most perfect Harmony.*

23. To render our ideas still more precise and permanent, we shall call the tone produced by the sonorous body *ut:* it is evident, by the first experiment, that this sound is always attended by its 12th and 17th major; that is to say, with the octave of *sol*, and the double octave of *mi*. 117 Fundamental and harmonics, what.

24. This octave of *sol* then, and this double octave of *mi*, produce the most perfect chord which can be joined with *ut*, since that chord is the work and choice of nature (E).

25. For the same reason, the modulation formed by *ut* with the octave of *sol* and the double octave of *mi*, sung one after the other, would likewise be the most simple and natural of all modulations which do not descend or ascend directly in the diatonic order, if our voices had sufficient compass to form intervals so great without difficulty; but the ease and freedom with which 118 Harmony reduced to chords, fifths, and octaves.

Thus the third minor, an harmonic sound which is even found in the protracted and coalescent tones of a sonorous body between the sound *mi* and *sol*, an harmonic of the principal sound, may be expressed by the fraction $\frac{6}{5}$.

N. B. One may see by this example, that in order to compare two sounds one with another which are expressed by fractions, it is necessary first to multiply the numerator of the fraction which expresses the first by the denominator of the fraction which expresses the second, which will give a primary number; as here the numerator 5 of the fraction $\frac{5}{4}$, multiplied by 2 of the fraction $\frac{3}{2}$, has given 10. Afterwards may be multiplied the numerator of the second fraction by the denominator of the first, which will give a secondary number, as here 12 is the product of 4 multiplied by 3; and the relation between these two numbers (which in the preceding example are 10 and 12), will express the relation between these sounds, or, what is the same thing, the interval which there is between the one and the other; in such a manner, that the farther the relation between these sounds departs from unity, the greater the interval will be.

Such is the manner in which we may compare two sounds one with another whose numerical value is known. We shall now show the manner how the numerical expression of a sound may be obtained, when the relation which it ought to have with another sound is known whose numerical expression is given.

Let us suppose, for example, that the third major of the fifth $\frac{3}{2}$ is sought. That third major ought to be, by what has been shown above, the $\frac{5}{4}$ of the fifth; for the third major of any sound whatever is the $\frac{5}{4}$ of that sound. We must then look for a fraction which expresses the $\frac{5}{4}$ of $\frac{3}{2}$; which is done by multiplying the numerators and denominators of both fractions one by the other, from whence results the new fraction $\frac{15}{8}$. It will likewise be found that the fifth of the fifth is $\frac{9}{4}$, because the fifth of the fifth is the $\frac{3}{2}$ of $\frac{3}{2}$.

Thus far we have only treated of fifths, fourths, thirds major and minor, in ascending; now it is extremely easy to find by the same rules the fifths, fourths, thirds major and minor in descending. For suppose *ut* equal to 1, we have seen that its fifth, its fourth, its third, its major and minor in ascending, are $\frac{3}{2}$, $\frac{4}{3}$, $\frac{5}{4}$, $\frac{6}{5}$. To find its fifth, its fourth, its third, its major and minor in descending, nothing more is necessary than to reverse these fractions, which will give $\frac{2}{3}$, $\frac{3}{4}$, $\frac{4}{5}$, $\frac{5}{6}$.

(D) It is not then imagined that we change the value of a sound in multiplying or dividing it by 2, by 4, or by 8, &c. the number which expresses these sounds, since by these operations we do nothing but take the simple, double, or triple octave, &c. of the sound in question, and that a sound coalesces with its octave.

(E) The chord formed with the twelfth and seventeenth major united with the principal sound, being exactly conformed to that which is produced by nature, is likewise for that reason the most agreeable of all; especially when the composer can proportion the voices and instruments together in a proper manner to give this chord its full effect. M. Rameau has executed this with the greatest success in the opera of *Pygmalion*, page 34. where Pygmalion sings with the chorus, *L'amour triomphe*, &c.: in this passage of the chorus, the two parts of the vocal and instrumental basses give the principal sound and its octave; the first part above, or treble, and that of the counter-tenor, produce the seventeenth major, and its octave, in descending; and in short, the second part, or tenor above, gives the twelfth.

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which we can ſubſtitute its octave to any ſound, when it is more convenient for the voice, afford us the means of repreſenting this modulation.

119 Mode major, what.

26. It is on this account that, after having ſung the tone *ut*, we naturally modulate the third *mi*, and the fifth *ſol*, inſtead of the double octave of *mi*, and the octave of *ſol*; from whence we form, by joining the octave of the ſound *ut*, this modulation, *ut*, *mi*, *ſol*, *ut*, which in effect is the ſimpleſt and eaſieſt of them all; and which likewiſe has its origin even in the protracted and compounded tones produced by a ſonorous body.

See *Mode*, See likewiſe *Interval*.

27. The modulation *ut*, *mi*, *ſol*, *ut*, in which the chord *ut*, *mi*, is a third major, conſtitutes that kind of harmony or melody which we call the *mode major*; from whence it follows, that this mode reſults from the immediate operation of nature.

120 Mode minor, what.

28. In the modulation *ut*, *mi*, *ſol*, of which we have now been treating, the ſounds *mi* and *ſol* are ſo proportioned one to the other, that the principal ſound *ut* (art. 19.) cauſes both of them to reſound; but the ſecond tone *mi* does not cauſe *ſol* to reſound, which only forms the interval of a third minor.

29. Let us then imagine, that, inſtead of this ſound *mi*, one ſhould ſubſtitute between the ſounds *ut* and *ſol* another note which (as well as the ſound *ut*) has the power of cauſing *ſol* to reſound, and which is, however, different from the ſound *ut*; the ſound which we explore ought to be ſuch, by art. 19. that it may have for its 17th major *ſol*, or one of the octaves of *ſol*; of conſequence the ſound which we ſeek ought to be a 17th major below *ſol*, or, what is the ſame thing, a third major below the ſame *ſol*. Now the ſound *mi* being a third minor beneath *ſol*, and the third major being (art. 9.) greater by a ſemitone than the third minor, it follows, that the ſound of which we are in ſearch ſhall be a ſemitone beneath the natural *mi*, and of conſequence *mi* ♭.

30. This new arrangement, *ut*, *mi* ♭, *ſol*, in which the ſounds *ut* and *mi* ♭ have both the power of cauſing *ſol* to reſound, though *ut* does not cauſe *mi* ♭ to reſound, is not indeed equally perfect with the firſt arrangement *ut*, *mi*, *ſol*; becauſe in this the two ſounds *mi* and *ſol* are both the one and the other generated by the principal ſound *ut*; whereas, in the other, the ſound *mi* ♭ is not generated by the ſound *ut*; but this arrangement *ut*, *mi* ♭, *ſol*, is likewiſe dictated by nature (art. 19.), though leſs immediately than the former; and accordingly experience evinces that the ear accommodates itſelf almoſt as well to the latter as to the former.

121 Origin of mode minor. See *Mode*. See alſo *Interval*.

31. In this modulation or chord *ut*, *mi* ♭, *ſol*, *ut*, it is evident that the third from *ut* to *mi* ♭ is minor; and ſuch is the origin of that mode which we call *minor* (F).

122 Perfect chords, what.

32. The moſt perfect chords then are, 1. All chords related one to another, as *ut*, *mi*, *ſol*, *ut*, conſiſting of any ſound of its third major, of its fifth, and of its octave. 2. All chords related one to another, as *ut* *mi* ♭, *ſol*, *ut*, conſiſting of any ſound, of its third minor, of its fifth, and of its octave. In effect, theſe two kinds of chords are exhibited by nature; but the firſt more immediately than the ſecond. The firſt are called *perfect chords major*, the ſecond *perfect chords minor*.

Chap. III. *Of the Series which the Fifth requires, and of the Laws which it obſerves.*

123 Fundamental baſs, what.

33. Since the ſound *ut* cauſes the ſound *ſol* to be heard, and is itſelf heard in the ſound *fa*, which ſounds *ſol* and *fa* are its two-twelfths, we may imagine a modulation compoſed of that ſound *ut* and its two-twelfths, or, which is the ſame thing (art. 22.), of its two-fifths; *fa* and *ſol*, the one below, the other above; which gives the modulation or ſeries of fifths *fa*, *ut*, *ſol*, which I call the *fundamental baſs* of *ut* by fifths.

We ſhall find in the ſequel (Chap. XVIII.), that there may be ſome fundamental baſes by thirds, deduced from the two ſeventeenths, of which the one is an attendant of the principal ſound, and of which the other includes that ſound. But we muſt advance ſtep by ſtep, and ſatisfy ourſelves at preſent to conſider immediately the fundamental baſes by fifths.

34. Thus, from the ſound *ut*, one may make a tranſition indifferently to the ſound *ſol*, or to the ſound *fa*.

35. One may, for the ſame reaſon, continue this kind of fifths in aſcending, and in deſcending, from *ut*, in this manner:

mi ♭, *ſi* ♭, *fa*, *ut*, *ſol*, *re*, *la*, &c.

And from this ſeries of fifths one may paſs to any ſound which immediately precedes or follows it.

36. But it is not allowed in the ſame manner to paſs

(F) The origin which we have here given of the mode minor, is the moſt ſimple and natural that can poſſibly be given. In the firſt edition of this treatiſe, I had followed M. Rameau in deducing it from the following experiment.—If you put in vibration a muſical ſtring AB, and if there are at the ſame time contiguous to this two other ſtrings CF, LM, of which the firſt ſhall be a twelfth below the ſtring AB, and the ſecond LM a ſeventeenth major below the ſame AB, the ſtrings CF, LM, will vibrate without being ſtruck as ſoon as the ſtring AB ſhall give a ſound, and divide themſelves by a kind of undulation, the firſt into three, the laſt into five equal parts; in ſuch a manner, that, in the vibration of the ſtring CF, you may eaſily diſtinguiſh two points at reſt D, E, and in the tremulous motion of the ſtring LM four acquieſcent points N, O, P, Q, all placed at equal diſtances from each other, and dividing the ſtrings into three or five equal parts. In this experiment, ſays M. Rameau, if we repreſent by *ut* the tone of the ſtring AB, the two other ſtrings will repreſent the ſounds *fa* and *la* ♭; and from thence M. Rameau deduces the modulation *fa*, *la* ♭, *ut*, and of conſequence the mode minor. The origin which we have aſſigned to the minor mode in this new edition, appears to me more direct and more ſimple, becauſe it preſuppoſes no other experiment than that of art. 19. and becauſe alſo the fundamental ſound *ut* is ſtill retained in both the modes, without being obliged, as M. Rameau found himſelf, to change it into *fa*. See *fig.* C.

heory of armony. pass from one sound to another which is not immediately contiguous to it; for instance, from *ut* to *re*, or from *re* to *ut*: for this very simple reason, that the sound *re* is not contained in the sound *ut*, nor the sound *ut* in that of *re*; and thus these sounds have not any alliance the one with the other, which may authorise the transition from one to the other.

124 eception the rule.

125 wo perct chords succeson proscrid.

37. And as these sounds *ut* and *re*, by the first experiment, naturally bring along with them the perfect chords consisting of greater intervals *ut, mi, sol, ut, re, fa*※, *la, re*; hence may be deduced this rule, That two perfect chords, especially if they are major (G), cannot succeed one another diatonically in a fundamental bass; we mean, that in a fundamental bass two sounds cannot be diatonically placed in succession, each of which, with its harmonics, forms a perfect chord, especially if this perfect chord be major in both.

Chap. IV. *Of Modes in general.*

126 ode in neral, hat.

38. A *mode*, in music, is nothing else but the order of sounds prescribed, as well in harmony as melody, by the series of fifths. Thus the three sounds *fa, ut, sol*, and the harmonics of each of these three sounds, that is to say, their thirds major and their fifths, compose all the major modes which are proper to *ut*.

127 odes, ow represented by e series of fths.

39. The series of fifths then, or the fundamental bass *fa, ut, sol*, of which *ut* holds the middle space, may be regarded as representing the mode of *ut*. One may likewise take the series of fifths, or fundamental bass, *ut, sol, re*, as representing the mode of *sol*; in the same manner *si* ♭, *fa, ut*, will represent the mode of *fa*.

By this we may see, that the mode of *sol*, or rather the fundamental bass of that mode, has two sounds in common with the fundamental bass of the mode of *ut*. It is the same with the fundamental bass of the mode *fa*.

128 rincipal ode, and djuncts, hat. ee *Adjunct*.

40. The mode of *ut (fa, ut, sol)* is called the *principal mode* with respect to the modes of these two fifths, which are called its two *adjuncts*.

129 odes reshed in roportion their ounds are mmon.

41. It is then, in some measure, indifferent to the ear whether a transition be made to the one or to the other of these adjuncts, since each of them has equally two sounds in common with the principal mode. Yet the mode of *sol* seems a little more eligible: for *sol* is heard amongst the harmonics of *ut*, and of consequence is implied and signified by *ut*; whereas *ut* does not cause *fa* to be heard, though *ut* is included in the same sound *fa*. It is hence that the ear, affected by the mode of *ut*, is a little more prepossessed for the mode of *sol* than for that of *fa*. Nothing likewise is more frequent, nor more natural, than to pass from the mode of *ut* to that of *sol*.

130 Dominant and sub-dominant, what. See *Dominant*.

42. It is for this reason, as well as to distinguish the two fifths one from the other, that we call *sol* the fifth above the generator the *dominant* sound, and the fifth *fa* beneath the generator the *subdominant*.

131 Transition to contiguous sounds, how to be managed.

43. It remains to add, as we have seen in the preceding chapter, that, in the series of fifths, we may indifferently pass from one sound to that which is contiguous: In the same manner, and for the same reason, one may pass from the mode of *sol* to the mode of *re*, after having made a transition from the mode of *ut* to the mode of *sol*, as from the mode of *fa* to the mode of *si* ♭. But it is necessary, however, to observe, that the ear which has been immediately affected with the principal mode feels always a strong propensity to return to it. Thus the further the mode to which we make a transition is removed from the principal mode, the less time we ought to dwell upon it; or rather, to speak in the terms of the art, the less ought the phrase (‡ *aa*) of that mode to be protracted.

Chap. V. *Of the Formation of the Diatonic Scale as used by the Greeks.*

44. From this rule, that two sounds which are contiguous may be placed in immediate succession in the series of fifths, *fa, ut, sol*, it follows, that one may form this modulation, or this fundamental bass, by fifths, *sol, ut, sol, ut fa, ut, fa*.

See fig. D.

132 Formation of the Greek diatonic scale by the fundamental bass.

45. Each of the sounds which forms this modulation brings necessarily along with itself its third major, its fifth, and its octave; insomuch that he who, for instance, sings the note *sol*, may be reckoned to sing at the same time the notes *sol, si, re, sol*: in the same manner the sound *ut* in the fundamental bass brings along with it this modulation, *ut, mi, sol, ut*; and, in short, the same sound *fa* brings along with it *fa, la, ut, fa*. This modulation then, or this fundamental bass,

sol, ut, sol, ut, fa, ut, fa,

gives the following diatonic series,

si, ut, re, mi, fa, sol, la;

which is precisely the diatonic scale of the Greeks. We are ignorant upon what principles they had formed this scale; but it may be sensibly perceived, that that series arises from the bass *sol, ut, sol, ut, fa, ut, fa*; and that of consequence this bass is justly called *fundamental*, as being the real primitive modulation, that which conducts *See* D.

(G) I say *especially if they are major*; for in the major chord *re, fa*※, *la, re*, besides that the sounds *ut* and *re* have no common harmonical relation, and are even dissonant between themselves (Art. 18.), it will likewise be found, that *fa*※ forms a dissonance with *ut*. The minor chord *re, fa, la, re*, would be more tolerable, because the natural *fa* which occurs in this chord carries along with it its fifth *ut*, or rather the octave of that fifth: It has likewise been sometimes the practice of composers, though rather by a licence indulged them than strictly agreeable to their art, to place a minor in diatonic succession to a major chord.

(‡ *aa*) As the mere English reader, unacquainted with the technical phraseology of music, may be surprised at the use of the word *phrase* when transferred from language to that art, we have thought proper to insert the definition of Rousseau.

A *phrase*, according to him, is in melody a series of modulations, or in harmony a succession of chords, which form without interruption a sense more or less complete, and which terminate in a repose by a cadence more or less perfect.

Theory of Harmony.

conducts the ear, and which it feels to be implied in the diatonic modulation, *ſi*, *ut*, *re*, *mi*, *fa*, *ſol*, *la*, (H).

46. We ſhall be ſtill more convinced of this truth by the following remarks.

In the modulation *ſi*, *ut*, *re*, *mi*, *fa*, *ſol*, *la*, the ſounds *re* and *fa* form between themſelves a third minor, which is not ſo perfectly true as that between *mi* and *ſol* (I). Nevertheleſs, this alteration in the third minor between *re* and *fa* gives the ear no pain, becauſe that *re* and that *fa*, which do not form between themſelves a true third minor, form, each in particular, conſonances perfectly juſt with the ſounds in the fundamental baſs which correſpond with them: for *re* in the ſcale is the true fifth of *ſol*, which anſwers to it in the fundamental baſs; and *fa* in the ſcale is the true octave of *fa*, which anſwers to it in the ſame baſs.

133
Altered intervals, no objection.

47. If, therefore, theſe ſounds in the ſcale form conſonances perfectly true with the notes which correſpond to them in the fundamental baſs, the ear gives itſelf little trouble to inveſtigate the alterations which there may be in the intervals which theſe ſounds in the ſcale form between themſelves. This is a new proof that the fundamental baſs is the genuine guide of the ear, and the true origin of the diatonic ſcale.

134
Reaſons why this ſcale includes only ſeven ſounds.

48. Moreover, this diatonic ſcale includes only ſeven ſounds, and goes no higher than *ſi*, which would be the octave of the firſt: a new ſingularity, for which a reaſon may be given by the principles above eſtabliſhed. In reality, in order that the ſound *ſi* may ſucceed immediately in the ſcale to the ſound *la*, it is neceſſary that the note *ſol*, which is the only one from whence *ſi* as a harmonic may be deduced, ſhould immediately ſucceed to the ſound *fa*, in the fundamental baſs, which is the only one from whence *la* can be harmonically deduced. Now, the diatonic ſucceſſion from *fa* to *ſol* cannot be admitted in the fundamental baſs, according to what we have remarked (art. 36.). The ſounds *la* and *ſi*, then, cannot immediately ſucceed one another in the ſcale: we ſhall ſee in the ſequel why this is not the caſe in the ſeries *ut*, *re*, *mi*, *fa*, *ſol*, *la*, *ſi*, *UT*, which begins upon *ut*; whereas the ſcale in queſtion here begins upon *ſi*.

135
Completion of t[he] Greek oc[tave]. See *Proſlambanomene*.

49. The Greeks likewiſe, to form an entire octave, added below the firſt *ſi* the note *la*, which they diſtinguiſhed and ſeparated from the reſt of the ſcale, and which for that reaſon they called *proſlambanomene*, that is to ſay, a ſtring or note ſubadded to the ſcale, and put before *ſi* to form the entire octave.

136
The ſcal[e] compoſe[d] of two ſi[mi]lar conju[nc]tive tetra[chords].

50. The diatonic ſcale *ſi*, *ut*, *re*, *mi*, *fa*, *ſol*, *la*, is compoſed of two tetrachords, that is to ſay, of two diatonic ſcales, each conſiſting of four ſounds, *ſi*, *ut*, *re*, *mi*, and *mi*, *fa*, *ſol*, *la*. Theſe two tetrachords are exactly ſimilar; for from *mi* to *fa* there is the ſame interval as from *ſi* to *ut*, from *fa* to *ſol* the ſame as from *ut* to *re*, from *ſol* to *la* the ſame as from *re* to *mi*

(H) Nothing is eaſier than to find in this ſcale the value or proportions of each ſound with relation to the ſound *ut*, which we call 1; for the two ſounds *ſol* and *fa* in the baſs are $\frac{3}{2}$ and $\frac{2}{3}$; from whence it follows,

1. That *ut* in the ſcale is the octave of *ut* in the baſs; that is to ſay, 2.
2. That *ſi* is the third major of *ſol*; that is to ſay $\frac{5}{4}$ of $\frac{3}{2}$ (note C), and of conſequence $\frac{15}{8}$.
3. That *re* is the fifth of *ſol*; that is to ſay $\frac{3}{2}$ of $\frac{3}{2}$, and of conſequence $\frac{9}{4}$.
4. That *mi* is the third major of the octave of *ut*, and of conſequence the double of $\frac{5}{4}$; that is to ſay, $\frac{5}{2}$.
5. That *fa* is the double octave of *fa* of the baſs, and conſequently $\frac{8}{3}$.
6. That *ſol* of the ſcale is the octave of *ſol* of the baſs, and conſequently 3.
7. In ſhort, that *la* in the ſcale is the third major of *fa* of the ſcale; that is to ſay, $\frac{5}{4}$ of $\frac{8}{3}$, or $\frac{10}{3}$.

Hence then will reſult the following table, in which each ſound has its numerical value above or below it.

Diatonic	$\frac{15}{8}$	2	$\frac{9}{4}$	$\frac{5}{2}$	$\frac{8}{3}$	3	$\frac{10}{3}$
Scale.	*ſi*,	*ut*,	*re*,	*mi*,	*fa*,	*ſol*,	*la*.
Fundamental	*ſol*,	*ut*,	*ſol*,	*ut*,	*fa*,	*ut*,	*fa*.
Baſs.	$\frac{3}{2}$	1,	$\frac{3}{2}$	1	$\frac{2}{3}$	1	$\frac{2}{3}$

And if, for the conveniency of calculation, we chooſe to call the ſound *ut*, of the ſcale 1; in this caſe there is nothing to do but to divide each of the numbers by 2, which repreſent the diatonic ſcale, and we ſhall have

$\frac{15}{16}$	1	$\frac{9}{8}$	$\frac{5}{4}$	$\frac{4}{3}$	$\frac{3}{2}$	$\frac{5}{3}$
ſi,	*ut*,	*re*,	*mi*,	*fa*,	*ſol*,	*la*.

(I) In order to compare *re* with *fa*, we need only compare $\frac{9}{8}$ with $\frac{4}{3}$; the relation between theſe fractions will be (Note C) that of 9 times 3 to 8 times 4; that is to ſay, of 27 to 32: the third minor, then, from *re* to *fa*, is not true; becauſe the proportion of 27 to 32 is not the ſame with that of 5 to 6, theſe two proportions being between themſelves as 27 times 6 is to 32 times 5, that is to ſay, as 162 to 160, or as the halves of theſe two numbers, that is to ſay, as 81 to 80.

M. Rameau, when he publiſhed, in 1726, his *New theoretical and practical Syſtem of Muſic*, had not as yet found the true reaſon of the alteration in the conſonance which is between *re* and *fa*, and of the little attention which the ear pays to it. For he pretends, in the work now quoted, that there are two thirds minor, one in the proportion of 5 to 6, the other in the proportion of 27 to 32. But the opinion which he has afterwards adopted, ſeems much preferable. In reality, the genuine third minor, is that which is produced by nature between *mi* and *ſol*, in the continued tone of thoſe ſonorous bodies of which *mi* and *ſol* are the two harmonics; and that third minor, which is in the proportion of 5 to 6, is likewiſe that which takes place in the minor mode, and not that third minor which is falſe and different, being in the proportion of 27 to 32.

1

eory of rmony.

mi (L): this is the reason why the Greeks distinguished these two tetrachords; yet they joined them by the note *mi*, which is common to both, and which gave them the name of *conjunctive tetrachords*.

137 ervals in h tetra- rds al.

51. Moreover, the intervals between any two sounds, taken in each tetrachord in particular, are precisely true: thus, in the first tetrachord, the intervals of *ut mi*, and *si re*, are thirds, the one major and the other minor, exactly true, as well as the fourth *si mi* (M); it is the same thing with the tetrachord *mi, fa, sol, la*, since this tetrachord is exactly like the former.

138 ervals ween the es of ferent rachords similar.

52. But the case is not the same when we compare two sounds taken each from a different tetrachord; for we have already seen, that the note *re* in the first tetrachord forms with the note *fa* in the second a third minor, which is not true. In like manner it will be found, that the fifth from *re* to *la* is not exactly true, which is evident; for the third major from *fa* to *la* is true, and the third minor from *re* to *fa* is not so: now, in order to form a true fifth, a third major and a third minor, which are both exactly true, are necessary.

139 other son for tinguish- the le into o tetra- ords.

53. From thence it follows, that every consonance is absolutely perfect in each tetrachord taken by itself; but that there is some alteration in passing from one tetrachord to the other. This is a new reason for distinguishing the scale into these two tetrachords.

140 e source tones jor and nor inve- gated.

54. It may be ascertained by calculation, that in the tetrachord *si, ut, re, mi*, the interval, or the tone from *re* to *mi*, is a little less than the interval or tone from *ut* to *re* (N). In the same manner, in the second tetrachord *mi, fa, sol, la*, which is, as we have proved, perfectly similar to the first, the note from *sol* to *la* is a little less than the note from *fa* to *sol*. It is for this reason that they distinguish two kinds of tones; the greater tone*, as from *ut* to *re*, from *fa* to *sol*, &c.; and the lesser †, as from *re* to *mi*, from *sol* to *la*, &c.

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* Greater tone. See *Interval.*

† Lesser tone. See *Interval.*

Chap. VI. *The formation of the Diatonic Scale among the Moderns, or the ordinary Gammut.*

141 The modern scale, how formed.

55. We have just shown in the preceding chapter, how the scale of the Greeks is formed, *si, ut, re, mi, fa, sol, la*, by means of a fundamental bass composed of three sounds only, *fa, ut, sol*: but to form the scale *ut, re, mi, fa, sol, la, si, UT*, which we use at present, we must necessarily add to the fundamental bass the note *re*, and form, with these four sounds *fa, ut, sol, re*, the following fundamental bass:

ut, sol, ut, fa, ut, sol, re, sol, ut; *See fig.* E. See *Scale.*

from whence we deduce the modulation or scale

ut, re, mi, fa, sol, la, si, UT.

In effect (O), *ut* in the scale belongs to the harmony of *ut* which corresponds with it in the bass; *re*, which is the second note in the gammut, is included in the harmony of *sol*, the second note of the bass; *mi*, the third note of the gammut, is a natural harmonic of *ut*, which is the third sound in the bass, &c.

142 The Greek diatonic scale simpler than ours, and why.

56. From thence it follows, that the diatonic scale of the Greeks is, at least in some respects, more simple than ours; since the scale of the Greeks (chap. v.) may be formed alone from the mode proper to *ut*; whereas ours is originally and primitively formed, not only from the mode of *ut* (*fa, ut, sol*), but likewise from the mode of *sol*, (*ut, sol, re*.)

It will likewise appear, that this last scale consists of two parts; of which the one, *ut, re, mi, fa, sol*, is in the

(L) The proportion of *si* to *ut* is as $\frac{15}{16}$ to 1, that is to say as 15 to 16; that between *mi* and *fa* is as $\frac{5}{4}$ to $\frac{4}{3}$, that is to say (note C), as 5 times 3 to 4 times 4, or as 15 to 16: these two proportions then are equal. In the same manner, the proportion of *ut* to *re* is as 1 to $\frac{9}{8}$, or as 8 to 9; that between *fa* and *sol* is as $\frac{4}{3}$ to $\frac{3}{2}$; that is to say (note C), as 8 to 9. The proportion of *mi* to *ut* is as $\frac{5}{4}$ to 1, or as 5 to 4; that between *fa* and *la* is as $\frac{5}{3}$ to $\frac{4}{3}$, or as 5 to 4: the proportions here then are likewise equal.

(M) The proportion of *mi* to *ut* is as $\frac{5}{4}$ to 1, or as 5 to 4, which is a true third major; that from *re* to *si* is as $\frac{9}{8}$ to $\frac{15}{16}$; that is to say, as 9 times 16 to 15 times 8, or as 9 times 2 to 15, or as 6 to 5. In like manner, we shall find, that the proportion of *mi* to *si* is as $\frac{5}{4}$ to $\frac{15}{16}$; that is to say, as 5 times 16 to 15 times 4, or as 4 to 3, which is a true fourth.

(N) The proportion of *re* to *ut* is as $\frac{9}{8}$ to 1, or as 9 to 8; that of *mi* to *re* is as $\frac{5}{4}$ to $\frac{9}{8}$, that is to say, as 40 to 36, or as 10 to 9: now $\frac{10}{9}$ is less removed from unity than $\frac{9}{8}$; the interval then from *re* to *mi* is a little less than that from *ut* to *re*.

If any one would wish to know the proportion which $\frac{10}{9}$ bear to $\frac{9}{8}$, he will find (note C) that it is as 8 times 10 to 9 times 9, that is to say, as 80 to 81. Thus the proportion of a lesser to a greater tone is as 80 to 81; this difference between the greater and lesser tone is what the Greeks called a *comma*.

We may remark, that this difference of a comma is found between the third minor when true and harmonical, and the same chord when it suffers alteration *re fa*, of which we have taken notice in the scale (note I); for we have seen, that this third minor thus altered is in the proportion of 80 to 81 with the true third minor.

(O) The values or estimates of the notes shall be the same in this as in the former scale, excepting only the tone *la*; for *re* being represented by $\frac{9}{8}$, its fifth will be expressed by $\frac{27}{16}$; so that the scale will be numerically signified thus:

$$\begin{matrix} 1 & \frac{9}{8} & \frac{5}{4} & \frac{4}{3} & \frac{3}{2} & \frac{27}{16} & \frac{15}{8} & 2 \\ ut, & re, & mi, & fa, & sol, & la, & si, & UT. \end{matrix}$$

Where you may see, that the note *la* of this scale is different from that in the scale of the Greeks; and that the *la* in the modern series stands in proportion to that of the Greeks as $\frac{27}{16}$ to $\frac{5}{3}$, that is to say, as 81 to 80; these two *la*'s then likewise differ by a *comma*.

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the mode of *ut*; and the other, *ſol*, *la*, *ſi*, *ut*, in that of *ſol*.

143 The note *ſol* twice repeated in the diatonic ſcale from its harmonic relations to the fundamental baſs.

57. It is for this reaſon that the note *ſol* is found to be twice repeated in immediate ſucceſſion in this ſcale; once as the fifth of *ut*, which correſponds with it in the fundamental baſs; and again, as the octave of *ſol*, which immediately follows *ut* in the ſame baſs. As to what remains, theſe two conſecutive *ſol's* are otherwiſe in perfect uniſon. It is for this reaſon that we are ſatisfied with ſinging only one of them when one modulates the ſcale *ut*, *re*, *mi*, *fa*, *ſol*, *la*, *ſi*, *UT*: but this does not prevent us from employing a pauſe or repoſe, expreſſed or underſtood, after the ſound *fa*. There is no perſon who does not perceive this whilſt he himſelf ſings the ſcale.

144 The modern ſcale compoſed of two disjunctive tetrachords of different modes.

58. The ſcale of the moderns, then, may be conſidered as conſiſting of two tetrachords, disjunctive indeed, but perfectly ſimilar one to the other, *ut*, *re*, *mi*, *fa*, and *ſol*, *la*, *ſi*, *ut*, one in the mode of *ut*, the other in that of *ſol*. For what remains, we ſhall ſee in the ſequel by what artifice one may cauſe the ſcale *ut*, *re*, *mi*, *fa*, *ſol*, *la*, *ſi*, *UT*, to be regarded as belonging to the mode of *ut* alone. For this purpoſe it is neceſſary to make ſome changes in the fundamental baſs, which we have already aſſigned: but this ſhall be explained at large in chap. xiii.

145 The mode of *ſol* introduced in the fundamental baſs productive of conveniences.

59. The introduction of the mode proper to *ſol* in the fundamental baſs has this happy effect, that the notes *fa*, *ſol*, *la*, *ſi*, may immediately ſucceed each other in aſcending the ſcale, which cannot take place (art. 48.) in the diatonic ſeries of the Greeks, becauſe that ſeries is formed from the mode of *ut* alone. From whence it follows:

1. That we change the mode at every time when we modulate three notes in ſucceſſion.

2. That if theſe three notes are ſung in ſucceſſion in the ſcale *ut*, *re*, *mi*, *fa*, *ſol*, *la*, *ſi*, *UT*, this cannot be done but by the aſſiſtance of a pauſe expreſſed or underſtood after the note *fa*; inſomuch, that the three tones *fa*, *ſol*, *la*, *ſi*, (three only becauſe the note *ſol* which is repeated is not enumerated) are ſuppoſed to belong to two different tetrachords.

146 Change of mode the cauſe of the difficulty in ſinging three conſecutive tones aſcending.

60. It ought not then any longer to ſurpriſe us, that we feel ſome difficulty whilſt we aſcend the ſcale in ſinging three tones in ſucceſſion, becauſe this is impracticable without changing the mode; and if one pauſes in the ſame mode, the fourth ſound above the firſt note will never be higher than a ſemitone above that which immediately precedes it; as may be ſeen by *ut*, *re*, *mi*, *fa*, and by *ſol*, *la*, *ſi*, *ut*, where there is no more than a ſemitone between *mi* and *fa*, and between *ſi* and *ut*.

147 Intervals, though altered in themſelves, form true conſonances with the fundamental baſs.

61. We may likewiſe obſerve in the ſcale *ut*, *re*, *mi*, *fa*, that the third minor from *re* to *fa* is not true, for the reaſons which have been already given (art. 49.). It is the ſame caſe with the third minor from *la* to *ut*, and with the third major from *fa* to *la*: but each of theſe ſounds form otherwiſe conſonances perfectly true, with their correſpondent ſounds in the fundamental baſs.

62. The thirds *la ut*, *fa la*, which were true in the former ſcale, are falſe in this; becauſe in the former ſcale *la* was the third of *fa*, and here it is the fifth of *re*, which correſponds with it in the fundamental baſs.

148 Fewer altered conſonances in the Greek ſcale than in ours.

63. Thus it appears, that the ſcale of the Greeks contains fewer conſonances that are altered than ours (P); and this likewiſe happens from the introduction of the mode of *ſol* into the fundamental baſs (Q).

We ſee likewiſe that the value of *la* in the diatonic ſcale, a value which authors have been divided in aſcertaining, ſolely depends upon the fundamental baſs, and that it muſt be different according as the note *la* has *fa* or *re* for its baſs. See the note (O).

Chap. VII. *Of Temperament.*

149 Temperament, why neceſſary.

64. The alterations which we have obſerved in the intervals between particular ſounds of the diatonic ſcale, naturally lead us to ſpeak of temperament. To give a clear idea of this, and to render the neceſſity of it palpable, let us ſuppoſe that we have before us an inſtrument with keys, a harpſichord, for inſtance, conſiſting of ſeveral octaves or ſcales, of which each includes its twelve ſemitones.

Let

(P) In the ſcale of the Greeks, the note *la* being a third from *fa*, there is an altered fifth between *la* and *re*: but in ours, *la* being a fifth to *re*, produces two altered thirds, *fa la*, and *la ut*; and likewiſe a fifth altered, *la mi*, as we ſhall ſee in the following chapter. Thus there are in our ſcale two intervals more than in the ſcale of the Greeks which ſuffer alteration.

(Q) But here it may be with ſome colour objected: The ſcale of the Greeks, it may be ſaid, has a fundamental baſs more ſimple than ours; and beſides, in it there are fewer chords which will not be found exactly true: why then, notwithſtanding this, does ours appear more eaſy to be ſung than that of the Greeks? The Grecian ſcale begins with a ſemitone, whereas the intonation prompted by nature ſeems to impel us to riſe by a full tone at once. This objection may be thus anſwered. The ſcale of the Greeks is indeed better diſpoſed than ours for the ſimplicity of the baſs, but the arrangement of ours is more ſuitable to natural intonation. Our ſcale commences by the fundamental ſound *ut*, and it is in reality from that ſound that we ought to begin; it is from this that all the others naturally ariſe, and upon this that they depend; nay, if I may ſpeak ſo, in this they are included: on the contrary, neither the ſcale of the Greeks, nor its fundamental baſs, commences with *ut*; but it is from this *ut* that we muſt depart, in order to regulate our intonation, whether in riſing or deſcending: now, in aſcending from *ut*, the intonation, even of the Greek ſcale, gives the ſeries *ut*, *re*, *mi*, *fa*, *ſol*, *la*: and ſo true is it that the fundamental ſound *ut* is here the genuine guide of the ear, that if, before we modulate the ſound *ut*, we ſhould attempt to riſe to it by that note in the ſcale which is moſt immediately contiguous, we cannot reach it but by the note *ſi*, and by the ſemitone from *ſi* to *ut*. Now to make a tranſition from *ſi* to *ut*, by this ſemitone, the ear muſt of neceſſity be prediſpoſed for that modulation, and conſequently preoccupied with the mode of *ut*: if this were not the caſe, we ſhould naturally riſe from *ſi* to *ut*✳, and by this operation paſs into another mode.

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Fig. F.

Let us choose in that harpsichord one of the strings which will sound the note UT, and let us tune the string SOL to a perfect fifth with UT in ascending; let us afterwards tune to a perfect fifth with this SOL the RE which is above it; we shall evidently perceive that this RE will be in the scale above that from which we set out: but it is also evident that this RE must have in the scale a *re* which corresponds with it, and which must be tuned a true octave below RE; and between this and SOL there should be the interval of a fifth; so that the *re* in the first scale will be a true fourth below the SOL of the same scale. We may afterwards tune the note LA of the first scale to a just fifth with this last *re*; then the note MI in the highest scale to a true fifth with this new LA, and of consequence the *mi* in the first scale to a true fourth beneath this same LA: Having finished this operation, it will be found that the last *mi*, thus tuned, will by no means form a just third major from the sound UT (R): that is to say, that it is impossible for *mi* to constitute at the same time the third major of UT and the true fifth of LA; or, what is the same thing, the true fourth of LA in descending.

65. What is still more, if, after having successively and alternately tuned the strings UT, SOL, *re*, LA, *mi*, in perfect fifths and fourths one from the other, we continue to tune successively by true fifths and fourths the strings *mi*, *si*, *fa*♯, *ut*♯, *sol*♯, *re*♯, *mi*♯, *si*♯; we shall find, that, though *si*♯, being a semitone higher than the natural note, should be equivalent to UT natural, it will by no means form a just octave to the first *ut* in the scale, but be considerably higher (S); yet this *si*♯ upon the harpsichord ought not to be different from the octave above UT; for every *si*♯ and every UT is the same sound, since the octave or the scale only consists of twelve semitones. 150

Reasons and rules for temperament.

66. From thence it necessarily follows, 1. That it is impossible that all the octaves and all the fifths should be just at the same time, particularly in instruments which have keys, where no intervals less than a semitone are admitted. 2. That, of consequence, if the fifths are justly tuned, some alteration must be made in the octaves; now the sympathy or sound which subsists between any note and its octave, does not permit us to make such an alteration: this perfect coalescence of sound is the cause why the octave should

(R) The LA considered as the fifth of *re* is $\frac{27}{16}$, and the fourth beneath this LA will constitute $\frac{3}{4}$ of $\frac{17}{16}$, that is to say, $\frac{81}{64}$; $\frac{81}{64}$ then shall be the value of *mi*, considered as a true fourth from LA in descending: now *mi*, considered as the third major of the sound UT, is $\frac{5}{4}$, or $\frac{80}{64}$: these two *mi*'s then are between themselves in the proportion of 81 to 80; thus it is impossible that *mi* should be at the same time a perfect third major from UT, and a true fourth beneath LA.

(S) In effect, if you thus alternately tune the fifth above, and the fourth below, in the same octave, you may here see what will be the process of your operation,

UT, SOL, a fifth; *re* a fourth; LA a fifth; *mi* a fourth; *si* a fifth; *fa*♯ a fourth; *ut*♯ a fifth; *sol*♯ a fourth; RE♯ a fifth; *la*♯ a fourth; MI♯ or FA a fifth; *si*♯ a fourth: now it will be found, by a very easy computation, that the first UT being represented by 1, SOL shall be $\frac{3}{2}$, *re* $\frac{9}{8}$, LA $\frac{27}{16}$, *mi* $\frac{81}{64}$, &c. and so of the rest till you arrive at *si*♯, which will be found $\frac{531441}{262144}$. This fraction is evidently greater than the number 2, which expresses the perfect octave *ut* to its correspondent UT; and the octave below *si*♯ would be one half of the same fraction, that is to say $\frac{531441}{524288}$, which is evidently greater than UT represented by unity. This last fraction $\frac{531441}{524288}$ is composed of two numbers; the numerator of the fraction is nothing else but the number 3 multiplied 11 times in succession by itself, and the denominator is the number 2 multiplied 18 times in succession by itself. Now it is evident, that this fraction, which expresses the value of *si*♯, is not equal to the unity which expresses the value of the sound UT; though, upon the harpsichord, *si*♯ and UT are identical. This fraction rises above unity by $\frac{7153}{524288}$, that is to say, by about $\frac{1}{73}$; and this difference was called the *comma of Pythagoras*. It is palpable that this comma is much more considerable than that which we have already mentioned (note N), and which is only $\frac{1}{80}$.

We have already proved that the series of fifths produces an *ut* different from *si*♯, the series of thirds major gives another still more different. For, let us suppose this series of thirds, *ut*, *mi*, *sol*♯, *si*♯, we shall have *mi* equal to $\frac{5}{4}$, *sol*♯ to $\frac{25}{16}$, and *si*♯ to $\frac{125}{64}$, whose octave below is $\frac{125}{128}$; from whence it appears, that this last *si* is less than unity (that is to say, than *ut*), by $\frac{3}{128}$, or by $\frac{1}{42}$, or near it: A new comma, much greater than the preceding, and which the Greeks have called *apotome major*.

It may be observed, that this *si*♯, deduced from the series of thirds, is to the *si*♯ deduced from the series of fifths, as $\frac{125}{128}$ is to $\frac{531441}{524288}$; that is to say, in multiplying by 524288, as 125 multiplied by 4096 is to 531441, or as 51200 to 531441, that is to say, nearly as 26 is to 27: from whence it may be seen, that these two *si*'s♯ are very considerably different one from the other, and even sufficiently different to make the ear sensible of it; because the difference consists almost of a minor semitone, whose value, as will afterwards be seen (art. 139.), is $\frac{25}{24}$.

Moreover, if, after having found the *sol*♯ equal to $\frac{25}{16}$, we then tune by fifths and by fourths, *sol*♯, *re*♯, *la*♯, *mi*♯, *si*♯, as we have done with respect to the first series of fifths, we find that the *si*♯ must be $\frac{2025}{2048}$; its difference, then, from unity, or, in other words, from UT, is $\frac{23}{2048}$, that is to say, about $\frac{1}{89}$; a comma still less than any of the preceding, and which the Greeks have called *apotome minor*.

In a word, if, after having found *mi* equal to $\frac{5}{4}$ in the progression of thirds, we then tune by fifths and fourths *mi*, *si*, *fa*♯, *ut*♯, &c. we shall arrive at a new *si*♯, which shall be $\frac{32805}{32768}$, and which will not differ from unity but by about $\frac{1}{885}$, which is the last and smallest of all the commas; but it must be observed, that, in this case, the thirds major from *mi* to *sol*♯, from *sol*♯ to *si*♯ or *ut*, &c. are extremely false, and greatly altered.

ſhould ſerve as limits to the other intervals, and that all the notes which riſe above or fall below the ordinary ſcale, are no more than replications, *i. e.* repetitions, of all that have gone before them. For this reaſon, if the octave were altered, there could be no longer any fixed point either in harmony or melody. It is then abſolutely neceſſary to tune the *ut* or *ſi*※ in a juſt octave with the firſt; from whence it follows, that, in the progreſſion of fifths, or what is the ſame thing, in the alternate ſeries of fifths and fourths, UT, SOL, *re*, LA, *mi*, *ſi*, *fa*※, *ut*※, *ſol*※, *re*※, *la*※, *mi*※, *ſi*※, it is neceſſary that all the fifths ſhould be altered, or at leaſt ſome of them. Now, ſince there is no reaſon why one ſhould rather be altered than another, it follows, that we ought to alter them all equally. By theſe means, as the alteration is made to influence all the fifths, it will be in each of them almoſt imperceptible; and thus the fifth, which, after the octave, is the moſt perfect of all conſonances, and which we are under the neceſſity of altering, muſt only be altered in the leaſt degree poſſible.

67. It is true, that the thirds will be a little harſh: but as the interval of ſounds which conſtitutes the third, produces a leſs perfect coaleſcence than that of the fifth, it is neceſſary, ſays M. Rameau, to ſacrifice the juſtice of that chord to the perfection of the fifth; for the more perfect a chord is in its own nature, the more diſpleaſing to the ear is any alteration which can be made in it. In the octave the leaſt alteration is inſupportable.

151 Its definition.

68. This change in the intervals of inſtruments which have, or even which have not, keys, is that which we call *temperament*.

152 Principle whence its theory may be deduced.

69. It reſults then from all that we have now ſaid, that the theory of temperament may be reduced to this queſtion—The alternate ſucceſſion of fifths and fourths having been given, UT, SOL, *re*, LA, *mi*, *ſi*, *fa*※, *ut*※, *ſol*※, *re*※, *la*※, *mi*※, *ſi*※, in which *ſi*※ or *ut* is not the true octave of the firſt UT, it is propoſed to alter all the fifths equally, in ſuch a manner that the two *ut's* may be in a perfect octave the one to the other.

153 Practical directions for temperament.

70. For a ſolution of this queſtion, we muſt begin with tuning the two *ut's* in a perfect octave the one to the other; in conſequence of which, we will render all the ſemitones which compoſe the octave as equal as poſſible. By this means (T) the alteration made in each fifth will be very conſiderable, but equal in all of them.

154 Rameau's method of temperament propoſed.

71. In this, then, the theory of temperament conſiſts: but as it would be difficult in practice to tune a harpſichord or organ by thus rendering all the ſemitones equal, M. Rameau, in his *Generation Harmonique*, has furniſhed us with the following method, to alter all the fifths as equally as poſſible.

72. Take any key of the harpſichord which you pleaſe; but let it be towards the middle of the inſtrument; for inſtance, UT: then tune the note SOL a fifth above it, at firſt with as much accuracy as poſſible; this you may imperceptibly diminiſh: tune afterwards the fifth to this with equal accuracy, and diminiſh it in the ſame manner; and thus proceed from one fifth to another

(T) All the ſemitones being equal in the temperament propoſed by M. Rameau, it follows, that the twelve ſemitones *ut*, *ut*※, *re*, *re*※, *mi*, *mi*※, &c. ſhall form a continued geometrical progreſſion; that is to ſay, a ſeries in which *ut* ſhall be to *ut*※ in the ſame proportion as *ut*※ to *re*, as *re* to *re*※, &c. and ſo of the reſt.

Theſe twelve ſemitones are formed by a ſeries of thirteen ſounds, of which *UT* and its octave *ut* are the firſt and laſt. Thus to find by computation the value of each ſound in the temperament, which is the preſent object of our ſpeculations, our ſcrutiny is limited to the inveſtigation of eleven other numbers between 1 and 2 which may form with the 1 and the 2 a continued geometrical progreſſion.

However little any one is practiſed in calculation, he will eaſily find each of theſe numbers, or at leaſt a number approaching to its value. Theſe are the characters by which they may be expreſſed, which mathematicians will eaſily underſtand, and which others may neglect.

UT	*ut*※	*re*	*re*※	*mi*	*fa*	*fa*※	*ſol*	*ſol*※
1	$\sqrt[12]{2}$	$\sqrt[12]{2^2}$	$\sqrt[12]{2^3}$	$\sqrt[12]{2^4}$	$\sqrt[12]{2^5}$	$\sqrt[12]{2^6}$	$\sqrt[12]{2^7}$	$\sqrt[12]{2^8}$
	la	*la*※	*ſi*	*ut*				
	$\sqrt[12]{2^9}$	$\sqrt[12]{2^{10}}$	$\sqrt[12]{\ }^{11}$	$\sqrt[12]{\ }^{12}$				

It is obvious, that in this temperament all the fifths are equally altered. One may likewiſe prove, that the alteration of each in particular is very inconſiderable; for it will be found, for inſtance, that the fifth from *ut* to *ſol*, which ſhould be $\frac{3}{2}$, ought to be diminiſhed by about $\frac{1}{12}$ of $\frac{1}{73}$; that is to ſay, by $\frac{1}{876}$, a quantity almoſt inconceivably ſmall.

It is true, that the thirds major will be a little more altered; for the third major from *ut* to *mi*, for inſtance, ſhall be increaſed in its interval by about $\frac{1}{100}$: but it is better, according to M. Rameau, that the alteration ſhould fall upon the third than upon the fifth, which after the octave is the moſt perfect chord, and from the perfection of which we ought never to degenerate but as little as poſſible.

Beſides, it has appeared from the ſeries of thirds major *ut*, *mi*, *ſol*※, *ſi*※, that this laſt *ſi*※ is very different from *ut* (note S); from whence it follows, that if we would tune this *ſi*※ in uniſon with the octave of *ut*, and alter at the ſame time each of the thirds major by a degree as ſmall as poſſible, they muſt all be equally altered. This is what occurred in the temperament which we propoſe; and if in it the third be more altered than the fifth, it is a conſequence of the difference which we find between the degrees of perfection in theſe intervals; a difference with which, if we may ſpeak ſo, the temperament propoſed conforms itſelf. Thus this diverſity of alteration is rather advantageous than inconvenient.

another in afcent: and as the ear does not appretiate fo exactly founds that are extremely fharp, it is neceffary, when by fifths you have rifen to notes extremely high, that you fhould tune in the moft perfect manner the octave below the laft fifth which you had immediately formed; then you may continue always in the fame manner; till in this procefs you arrive at the laft fifth from *mi*※ to *fi*※, which fhould of themfelves be in tune; that is to fay, they ought to be in fuch a ftate, that *fi*※, the higheft note of the two which compofe the fifth, may be identical with the found UT, with which you began, or at leaft the octave of that found perfectly juft: it will be neceffary then to try if this UT, or its octave, forms a juft fifth with the laft found *mi*※ or *fa* which has been already tuned. If this be the cafe, we may be certain that the harpfichord is properly tuned. But if this laft fifth be not true, in this cafe it will be too fharp, and it is an indication that the other fifths have been too much diminifhed, or at leaft fome of them; or it will be too flat, and confequently difcover that they have not been fufficiently diminifhed. We muft then begin and proceed as formerly, till we find the laft fifth in tune of itfelf, and without our immediate interpofition (υ).

By

(υ) All that remains, is to acknowledge, with M. Rameau, that this temperament is far remote from that which is now in practice: you may here fee in what this laft temperament confifts as applied to the organ or harpfichord. They begin with *UT* in the middle of the keys, and they flatten the four firft fifths *fol*, *re*, *la*, *mi*, till they form a true third major from *mi* to *ut;* afterwards, fetting out from this *mi*, they tune the fifths *fi*, *fa*※, *ut*※, *fol*※, but flattening them ftill lefs than the former, fo that *fol*※ may almoft form a true third major with *mi*. When they have arrived at *fol*※, they ftop; they refume the firft *ut*, and tune to it the fifth *fa* in defcending, then the fifth *fi*♭, &c. and they heighten a little all the fifths till they have arrived at *la*♭, which ought to be the fame with the *fol*※ already tuned.

If, in the temperament commonly practifed, fome thirds are found to be lefs altered than in that prefcribed by M. Rameau, in return, the fifths in the firft temperament are much more falfe, and many thirds are likewife fo; infomuch, that upon a harpfichord tuned according to the temperament in common ufe, there are five or fix modes which the ear cannot endure, and in which it is impoffible to execute any thing. On the contrary, in the temperament fuggefted by M. Rameau, all the modes are equally perfect; which is a new argument in its favour, fince the temperament is peculiarly neceffary in paffing from one mode to another, without fhocking the ear; for inftance, from the mode of *ut* to that of *fol*, from the mode of *fol* to that of *re*, &c. It is true, that this uniformity of modulation will to the greateft number of muficians appear a defect: for they imagine, that, by tuning the femitones of the fcale unequal, they give each of the modes a peculiar character; fo that, according to them, the fcale of *ut*,

ut, *re*, *mi*, *fa*, *fol*, *la*, *fi*, *UT*,

is not perfectly fimilar to the gammut or diatonic fcale of the mode of *mi*

mi, *fa*※, *fol*※, *la*※, *fi*, *ut*※, *re*※, *mi*,

which, in their judgment, renders the modes of *ut* and *mi* proper for different manners of expreffion. But after all that we have faid in this treatife on the formation of diatonic intervals, every one fhould be convinced, that, according to the intention of nature, the diatonic fcale ought to be perfectly the fame in all its modes: The contrary opinion, fays M. Rameau, is a mere prejudice of muficians. The character of an air arifes chiefly from the intermixture of the modes; from the greater or leffer degrees of vivacity in the movement; from the tones, more or lefs grave, or more or lefs acute, which are affigned to the generator of the mode; and from the chords more or lefs beautiful, as they are more or lefs deep, more or lefs flat, more or lefs fharp, which are found in it.

In fhort, the laft advantage of this temperament is, that it will be found conformed, or at leaft very little different from that which they practife upon inftruments without keys; as the bafs-viol, the violin, in which true fifths and fourths are preferred to thirds and fixths tuned with equal accuracy; a temperament which appears incompatible with that commonly ufed in tuning the harpfichord.

Yet we muft not fuffer our readers to be ignorant, that M. Rameau, in his *New Syftem of Mufic*, printed in 1726, had adopted the ordinary temperament. In that work, (as may be feen CHAP. XXIV.), he pretends that the alteration of the fifths is much more fupportable than that of the thirds major; and that this laft interval can hardly fuffer a greater alteration than the octave, which, as we know, cannot fuffer the flighteft alteration. He fays, that if three ftrings are tuned, one by an octave, the other by a fifth, and the next by a third major to a fourth ftring, and if a found be produced from the laft, the ftrings tuned by a fifth will vibrate, though a little lefs true than it ought to have been; but that the octave and the third major, if altered in the leaft degree, will not vibrate: and he adds, that the temperament which is now practifed, is founded upon that principle. M. Rameau goes ftill farther; and as, in the ordinary temperament, there is a neceffity for altering the laft thirds major, and to make them a little more fharp, that they may naturally return to the octave of the principal found, he pretends that this alteration is tolerable, not only becaufe it is almoft infenfible, but becaufe it is found in modulations not much in ufe, unlefs the compofer fhould choofe it on purpofe to render the expreffion ftronger. "For it is proper to remark (fays he), that we receive different impreffions from the intervals in proportion to their different alterations: for inftance, the third major, which naturally elevates us to joy, in proportion as we feel it, heightens our feelings even to a kind of fury, when it is tuned too fharp; and the third minor, which naturally infpires us with tendernefs and ferenity, depreffes us to melancholy when it is too flat." All this ftrain, as you may fee, is immenfely different from that which this celebrated mufician afterwards

Theory of Harmony.

By this method all the twelve sounds which compose one of the scales shall be tuned: nothing is necessary but to tune with the greatest possible exactness their octaves in the other scales, and the harpsichord shall be well tuned.

155 Alterations by either method hardly disagreeable.

We have given this rule for temperament from M. Rameau; and it belongs only to disinterested artists to judge of it. However this question be determined, and whatever kind of temperament may be received, the alterations which it produces in harmony will be but very small, or not perceptible to the ear, whose attention is entirely engrossed in attuning itself with the fundamental bass, and which suffers, without uneasiness, these alterations, or rather takes no notice of them, because it supplies from itself what may be wanting to the truth and perfection of the intervals.

Simple and daily experiments confirm what we now advance. Listen to a voice which is accompanied, in singing, by different instruments; though the temperament of the voice, and the temperament of each of the instruments, are all different one from another, yet you will not be in the least affected with the kind of cacophony which ought to result from these diversities, because the ear supposes these intervals true of which it does not appreciate differences.

We may give another experiment. Strike upon an organ the three keys *mi, sol, si*, you will hear nothing but the minor perfect chord; though *mi*, by the construction of that instrument, must cause *sol*※ likewise to be heard; though *sol* should have the same effect upon *re*, and *si* upon *fa*※; insomuch, that the ear is at once affected with all these sounds, *re, mi, fa*※, *sol, sol*※, *si*: how many dissonances perceived at the same time, and what a jarring multitude of discordant sensations, would result from thence to the ear, if the perfect chord with which it is preoccupied had not power entirely to abstract its attention from such sounds as might offend!

Chap. VIII. *Of Reposes or Cadences* (†).

156 Cadences perfect and imperfect, what and why.

73. In a fundamental bass whose procedure is by fifths, there always is, or always may be, a *repose*, or crisis, in which the mind acquiesces in its transition from one sound to another: but a repose may be more or less distinctly signified, and of consequence more or less perfect. If one should rise by fifths; if, for instance, we pass from *ut* to *sol*; it is the generator which passes to one of these fifths, and this fifth was already pre-existent in its generator: but the generator exists no longer in this fifth; and the ear, as this generator is the principle of all harmony and of all melody, feels a desire to return to it. Thus the transition from a sound to its fifth in ascent, is termed an *imperfect repose*, or *imperfect cadence*; but the transition from any sound to its fifth in descent, is denominated a *perfect cadence*, or an *absolute repose*: it is the offspring which returns to its generator, and as it were recovers its existence once more in that generator itself, with which when sounding it resounds (chap. i.)

See *Repose* or *Cadence*.

157 Perfect cadences more or less perfect and why.

74. Amongst absolute reposes, there are some, if we may be allowed the expression, more absolute, that is to say, more perfect, than others. Thus in the fundamental bass

ut, sol, ut, fa, ut, sol, re, sol, ut,

which forms, as we have seen, the diatonic scale of the moderns, there is an absolute repose from *re* to *sol*, as from *sol* to *ut*: yet this last absolute repose is more perfect than the preceding, because the ear, prepossessed with the mode of *ut* by the multiplied impression of the sound *ut* which it has already heard thrice before, feels a desire to return to the generator *ut*; and it accordingly does so by the absolute repose *sol, ut.*

158 Cadence in melody different from what it is in harmony.

75. We may still add, that what is commonly called *cadence* in melody, ought not to be confounded with what we name *cadence* in harmony.

In the first case, this word only signifies an agreeable and rapid alteration between two contiguous sounds, called likewise a *trill* or *shake*; in the second, it signifies a repose or close. It is however true, that this shake implies, or at least frequently enough presages, a repose, either present or impending, in the fundamental bass (x).

159 Cadences in the fundamental bass necessary in the diatonic scale, and which the most perfect.

76. Since there is a repose in passing from one sound to another in the fundamental bass, there is also a repose in passing from one note to another in the diatonic scale, which is formed from it, and which this bass represents: and as the absolute repose *sol ut*, is of

terwards exhibited in his *Generation Harmonique*, and in the performances which followed it. From this we can only conclude, that the reasons which, after him, we have urged for the new temperament, must without doubt have appeared to him very strong, because in his mind they had superseded those which he had formerly adduced in favour of the ordinary temperament.

We do not pretend to give any decision for either the one or the other of these methods of temperament, each of which appears to us to have its particular advantages. We shall only remark, that the choice of the one or the other must be left absolutely to the taste and inclination of the reader; without, however, admitting this choice to have any influence upon the principles of the system of music, which we have followed even till this period, and which must always subsist, whatever temperament we adopt.

(†) That the reader may have a clear idea of the term before he enters upon the subject of this chapter, it may be necessary to caution him against a mistake into which he may be too easily led by the ordinary signification of the word *repose*. In music, therefore, it is far from being synonymous with the word *rest*. It is, on the contrary, the termination of a musical *phrase* which ends in a cadence more or less emphatic, as the sentiment implied in the phrase is more or less complete. Thus a repose in music answers the same purpose as punctuation in language. See Repos in Rousseau's Musical Dictionary.

(x) M. Rousseau, in his letter on French music, has called this alternate undulation of different sounds a *trill*, from the Italian word *trillo*, which signifies the same thing; and some French musicians already appear to have adopted this expression.

eory of rmony.

of all others the moſt perfect in the fundamental baſs, the repoſe from *ſi* to *ut*, which anſwers to it in the ſcale, and which is likewiſe terminated by the generator, is for that reaſon the moſt perfect of all others
160 in the diatonic ſcale aſcending.

finition d uſe of a ſible e.

77. It is then a law dictated by nature itſelf, that if you would aſcend diatonically to the generator of a mode, you can only do this by means of the third major from the fifth of that very generator. This third major, which with the generator forms a ſemitone, has for that reaſon been called the *ſenſible note*, as introducing the generator, and preparing us for the moſt perfect repoſe.

Senſible te.

We have already proved, that the fundamental baſs is the principle of melody. We ſhall beſides make it appear in the ſequel, that the effect of a repoſe in melody ariſes ſolely from the fundamental baſs.

Chap. IX. *Of the Minor Mode and its Diatonic Series.*

161 e diato- ſeries of minor de aſcer- ned by ferent mples.

78. In the ſecond chapter, we have explained (art. 29. 30. 31. and 32.) by what means, and upon what principle, the minor chord *ut, mi♭, ſol, ut*, may be formed, which is the characteriſtical chord of the minor mode. Now what we have there ſaid, taking *ut* for the principal and fundamental ſound, we might likewiſe have ſaid of any other note in the ſcale, aſſumed in the ſame manner as the principal and fundamental ſound: but as in the minor chord *ut, mi♭, ſol, ut*, there occurs a *mi♭* which is not found in the ordinary diatonic ſcale, we ſhall immediately ſubſtitute, for greater eaſe and conveniency, another chord, which is likewiſe minor and exactly ſimilar to the former, of which all the notes are found in the ſcale.

79. The ſcale affords us three chords of this kind, viz. *re, fa, la, re*; *la, ut, mi, la*; and *mi, ſol, ſi, mi*. Amongſt theſe three we ſhall chooſe *la, ut, mi, la*; becauſe this chord, without including any ſharp or flat, has two ſounds in common with the major chord *ut, mi, ſol, ut*; and beſides, one of theſe two ſounds is the very ſame *ut*: ſo that this chord appears to have the moſt immediate, and at the ſame time the moſt ſimple, relation with the chord *ut, mi, ſol, ut*. Concerning this we need only add, that this preference of the chord *la, ut, mi, la*, to every other minor chord, is by no means in itſelf neceſſary for what we have to ſay in this chapter upon the diatonic ſcale of the minor mode. We might in the ſame manner have choſen any other minor chord; and it is only, as we have ſaid, for greater eaſe and conveniency that we fix upon this.

162 nic or in harny, at. Princi- Tonic.

80. Let us now remark, that in every mode, whether major or minor, the *principal* ſound which implies the perfect chord, whether major or minor, may be called the *tonic note* or *key*; thus *ut* is the key in its proper mode, *la* in the mode of *la*, &c. Having laid down this principle,

163 e forma- of the purſu- fig. D.

81. We have ſhown how the three ſounds *fa, ut, ſol*, which conſtitute (art. 38.) the mode of *ut*, of which the firſt *fa* and the laſt *ſol* are the two fifths of *ut*, one deſcending the other riſing, produce the ſcale *ſi, ut, re, mi, fa, ſol, la*, of the major mode, by means of the fundamental baſs *ſol, ut, ſol, ut, fa, ut, fa*: let us in the ſame manner take the three ſounds *re, la, mi*, which conſtitute the mode of *la*, for the ſame reaſon that the ſounds *fa, ut, ſol*, conſtitute the mode of *ut*; and of them let us form this fundamental baſs, perfectly like the preceding, *mi, la, mi, la, re, la, re*: let us afterwards place below each of theſe ſounds one of their harmonics, as we have done (chap. v.) for the firſt ſcale of the major mode; with this difference, that we muſt ſuppoſe *re* and *la* as implying their thirds minor in the fundamental baſs to characteriſe the minor mode; and we ſhall have the diatonic ſcale of that mode,

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See fig. G.

ſol♯, la, ſi, ut, re, mi, fa.

82. The *ſol♯*, which correſponds with *mi* in the fundamental baſs, forms a third major with that *mi*, though the mode be minor; for the ſame reaſon that a third from the fifth of the fundamental ſound ought to be major (art. 77.) when that third riſes to the fundamental ſound *la*.

See *Imply* or *Carry*.

83. It is true, that, in cauſing *mi* to imply its third major *ſol*, one might alſo riſe to *la* by a diatonic progreſs. But that manner of riſing to *la* would be leſs perfect than the preceding; for this reaſon (art. 76.), that the abſolute repoſe or perfect cadence, *mi, la*, which is found in the fundamental baſs, ought to be repreſented in the moſt perfect manner in the two notes of the diatonic ſcale which anſwer to it, eſpecially when one of theſe two notes is *la*, the key itſelf upon which the repoſe is made. From whence it follows, that the preceding note *ſol* ought rather to be ſharp than natural; becauſe *ſol♯*, being included in *mi* (art. 19.), much more perfectly repreſents the note *mi* in the baſs, than the natural *ſol* could do, which is not included in *mi*. 164

84. We may remark this firſt difference between the ſcale Diverſities in the ſcales of the major and minor modes.

ſol♯, la, ſi, ut, re, mi, fa,

and the ſcale which correſponds with it in the major mode

ſi, ut, re, mi, fa, ſol, la,

that from *mi* to *fa*, which are the two laſt notes of the former ſcale, there is only a ſemitone; whereas from *ſol* to *la*, which are the two laſt ſounds of the latter ſeries, there is the interval of a complete tone: but this is not the only diſcrimination which may be found between the ſcales of the two modes. 165

85. To inveſtigate theſe differences, and to diſcover the reaſon for which they happen, we ſhall begin by forming a new diatonic ſcale of the minor mode, ſimilar to the ſecond ſcale of the major mode, Inveſtigation of theſe differences and their reaſons.

ut, re, mi, fa, ſol, ſol, la, ſi, ut. *See fig. E.*

That laſt ſeries, as we have ſeen, was formed by means of the fundamental baſs *fa, ut, ſol, re*, diſpoſed in this manner,

ut, ſol, ut, fa, ut, ſol, re, ſol, ut.

Let us take in the ſame manner the fundamental baſs *re la mi ſi*, and arrange it in the following order,

la, mi, la, re, la, mi, ſi, mi, la, *See fig. H.*

and it will produce the ſcale immediately ſubjoined,

la, ſi, ut, re, mi, mi, fa♯, ſol♯, la,

in which *ut* forms a third minor with *la*, which in the fundamental baſs correſponds with it, which denominates the minor mode; and, on the contrary, *ſol♯* forms a third major with *mi* in the fundamental baſs, becauſe *ſol♯* riſes towards *la*, (art. 82. and 83.)

86. We ſee beſides a *fa*✱, which does not occur in the former,

ſol✱, *la*, *ſi*, *ut*, *re*, *mi*, *fa*,

where *fa* is natural. It is becauſe, in the firſt ſcale, *fa* is a third minor from *re* in the baſs; and in the ſecond, *fa*✱ is the fifth from *ſi* in the baſs.

166 Difference between the two ſcales of the minor mode greater than between thoſe of the major.

87. Thus the two ſcales of the minor mode are ſtill in this reſpect more different one from the other than the two ſcales of the major mode; for we do not remark this difference of a ſemitone between the two ſcales of the major mode. We have only obſerved (art. 63.) ſome difference in the value of *la* as it ſtands in each of theſe ſcales, but this amounts to much leſs than a ſemitone.

167 *Fa* and *ſol* ſharp in the minor mode, and why.

88. From thence it may be ſeen why *fa* and *ſol* are ſharp when aſcending in the minor mode; nay, beſides, the *fa* is only natural in the firſt ſcale *ſol*✱, *la*, *ſi*, *ut*, *re*, *mi*, *fa*, becauſe this *fa* cannot riſe to *ſol*✱, (art. 48.)

168 The caſe different in deſcending, and why.

89. It is not the ſame caſe in deſcending. For *mi*, the fifth of the generator, ought not to imply the third major *ſol*✱, but in the caſe when that *mi* deſcends to the generator *la* to form a perfect repoſe (art. 77. and 83.); and in this caſe the third major *ſol*✱ riſes to the generator *la*: but the fundamental baſs *la mi* may, in deſcending, give the ſcale *la ſol* natural, provided *ſol* does not riſe towards *la*.

169 Explication of the deſcending ſcale in the minor mode from a fundamental baſs difficult.

90. It is much more difficult to explain how the *fa*, which ought to follow this *ſol* in deſcending, is natural and not ſharp; for the fundamental baſs

la, *mi*, *ſi*, *mi*, *la*, *re*, *la*, *mi*, *la*,

produces in deſcending,

la, *ſol*, *fa*✱, *mi*, *mi*, *re*, *ut*, *ſi*, *la*.

And it is plain that the *fa* cannot be otherwiſe than ſharp, ſince *fa*✱ is the fifth of the note *ſi* of the fundamental baſs. In the mean time, experience evinces that the *fa* is natural in deſcending in the diatonic ſcale of the major mode of *la*, eſpecially when the preceding *ſol* is natural: and it muſt be acknowledged, that here the fundamental baſs appears in ſome meaſure defective.

170 Rameau's ſolution, though the only one, yet unſatisfactory.

M. Rameau has invented the following means for obtaining a ſolution of this difficulty. According to him, in the diatonic ſcale of the minor mode in deſcending, *la*, *ſol*, *fa*, *mi*, *re*, *ut*, *ſi*, *la*, *ſol*, may be regarded ſimply as a note of paſſage, merely added to give ſweetneſs to the modulation, and as a diatonic gradation by which we may deſcend to *fa* natural. It is eaſily perceived, according to M. Rameau, by this fundametal baſs,

la, *re*, *la*, *re*, *la*, *mi*, *la*,

which produces

la, *fa*, *mi*, *re*, *ut*, *ſi*, *la*;

which may be regarded, as he ſays, as the real ſcale of the minor mode in deſcending; to which is added *ſol* natural between *la* and *fa*, to preſerve the diatonic order.

This anſwer appears the only one which can be given to the difficulty above propoſed: but I know not whether it will fully ſatisfy the reader; whether he will not ſee with regret, that the fundamental baſs does not produce, to ſpeak properly, the diatonic ſcale of the minor mode in deſcent, when at the ſame time this ſame baſs ſo happily produces the diatonic ſcale of that identical mode in aſcending, and the diatonic ſcale of the major mode whether in riſing or deſcending (Y).

Chap. X. *Of Relative Modes.*

171 Modes relative, what.

91. Two modes which are of ſuch a nature that we can paſs from the one to the other, are called *relative modes*. Thus we have already ſeen, that the major mode of *ut* is relative to the major mode of *fa* and to that of *ſol*. It may likewiſe appear from what goes before, how many intimate connections there are between the *ſpecies* (†) or major mode of *ut*, and the *ſpecies* or minor mode of *la*. For, 1. The perfect chords, one major *ut mi ſol ut*, the other minor *la ut mi la*, which characteriſe each of thoſe two kinds of modulation* or harmony, have two ſounds in common, *ut* or *mi*. 2. The diatonic ſcale of the minor mode of *la* in deſcent, abſolutely contains the ſame ſounds with the gammut or diatonic ſcale of the major mode of *ut*.

* See Modulation.

It is for this reaſon that the tranſition is ſo natural and eaſy from the major mode of *ut* to the minor mode of *la*, or from the minor mode of *la* to the major mode of *ut*, as experience proves.

92. In the minor mode of *mi*, the minor perfect chord *mi ſol ſi mi*, which characteriſes it, has likewiſe two ſounds, *mi*, *ſol*, in common with the perfect chord major *ut mi ſol ut*, which characteriſes the major mode of *ut*. But the minor mode of *mi* is not ſo cloſely related nor allied to the major mode of *ut* as to the minor mode of *la*; becauſe the diatonic ſcale of the minor mode of *mi* in deſcent, has not, like the ſeries of the

(Y) For what remains, when *ſol* is ſaid to be natural in deſcending the diatonic ſcale of the minor mode of *la*, this only ſignifies, that this *ſol* is not neceſſarily ſharp in deſcending as it is in riſing; for this *ſol*, beſides, may be ſharp in deſcending to the minor mode of *la*, as may be proved by numberleſs examples, of which all muſical compoſitions are full. It is true, that when the ſound *ſol* is found ſharp in deſcending to the minor mode of *la*, ſtill we are not ſure that the mode is minor till the *fa* or *ut* natural is found; both of which impreſs a peculiar character on the minor mode, viz. *ut* natural, in riſing and in deſcending, and the *fa* natural in deſcending.

(†) *Species* was the only word which occurred to the tranſlator in Engliſh by which he could render the French word *genre*. It is, according to Rouſſeau, intended to expreſs the different diviſions and diſpoſitions of the intervals which formed the two tetrachords in the ancient diatonic ſcale; and as the gammut of the moderns conſiſts likewiſe of two tetrachords, though diverſified from the former, as our author has ſhown at large, the *genre* or *ſpecies*, as the tranſlator has been obliged to expreſs it, muſt conſiſt in the various diſpoſitions and diviſions of the different intervals between the notes or ſemitones which compoſe the modern ſcale.

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the minor mode of *la*, all these sounds in common with the scale of *ut*. In reality, this scale is *mi re ut si la sol fa*✻ *mi*, where there occurs a *fa* sharp which is not in the scale of *ut*. We may add, that though the minor mode of *mi* is less relative to the major mode of *ut* than that of *la*; yet the artist does not hesitate sometimes to pass immediately from the one to the other.

Of this may be seen one instance (among many others) in the prologue *des Amours des Dieux*, at this passage, *Ovide est l'objet de la fete*, which is in the minor mode of *mi*, though what immediately precedes it is in the major mode of *ut*.

We may see besides, that when we pass from one mode to another by the interval of a third, whether in descending or rising, as from *ut* to *la*, or from *la* to *ut*, from *ut* to *mi*, or from *mi* to *ut*, the major mode becomes minor, or the minor mode becomes major.

93. There is still another minor mode, into which an immediate transition may be made in issuing from the major mode of *ut*. It is the minor mode of *ut* itself in which the perfect minor chord *ut mi*♭ *sol ut* has two sounds, *ut* and *sol*, in common with the perfect major chord *ut mi sol ut*. Nor is there any thing more common than a transition from the major mode of *ut* to the minor mode, or from the minor to the major(z).

Chap. XI. *Of Dissonance.*

172 ases in hich the ode is uncertain.

94. We have already observed, that the mode of *ut* (*fa, ut, sol*), has two sounds in common with the mode of *sol* (*ut, sol, re*); and two sounds in common with the mode of *fa* (*si*♭, *fa, ut*); of consequence, this procedure of the bass *ut sol* may belong to the mode of *ut*, or to the mode of *sol*, as the procedure of the bass *fa ut*, or *ut fa*, may belong to the mode of *ut* or the mode of *fa*. When any one therefore passes from *ut* to *fa* or to *sol* in a fundamental bass, he is still ignorant even to that crisis what mode he is in. It would be, however, advantageous to know it, and to be able by some means to distinguish the generator from its fifths.

173 ow we ay investigate the nerator d its ths, and that eans determine the ode.

95. This advantage may be obtained by uniting at the same time the sounds *sol* and *fa* in the same harmony, that is to say, by joining to the harmony *sol si re* of the fifth *sol*, the other fifth *fa* in this manner, *sol, si, re, fa*; this *fa* which is added, forms a dissonance with *sol* (art. 18.) It is for that reason that the chord *sol si re fa*, is called a *dissonant* chord, or a chord of the seventh. It serves to distinguish the fifth *sol* from the generator *ut*, which always implies, without mixture or alteration, the perfect chord *ut, mi, sol, ut*, resulting from nature itself (art. 32.) By this we may see, that when we pass from *ut* to *sol*, one passes at the same time from *ut* to *fa*, because *fa* is found to be comprehended in the chord of *sol*; and the mode of *ut* by these means plainly appears to be determined, because there is none but that mode to which the sounds *fa* and *sol* at once belong.

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174 Manner of treating dissonances continued.

96. Let us now see what may be added to the harmony *fa, la, ut*, of the fifth *fa* below the generator, to distinguish this harmony from that of the generator. It seems probable at first, that we should add to it the other fifth *sol*, so that the generator *ut*, in passing to *fa*, may at the same time pass to *sol*, and that by this the mode should be determined: but this introduction of *sol*, in the chord *fa, la, ut*, would produce two seconds in succession *fa, sol, sol, la*, that is to say, two dissonances whose union would prove extremely harsh to the ear; an inconvenience which ought carefully to be avoided. For if, to distinguish the mode, we should alter the harmony of the fifth *fa* in the fundamental bass, it must only be altered in the least degree possible.

175 Chord of the great fixth.

97. For this reason, instead of *sol*, we shall take its fifth *re*, which is the sound that approaches it the nearest; and we shall have, instead of the fifth *fa*, the chord *fa, la, ut, re*, which is called a *chord of the great sixth*.

One may here remark the analogy there is observed between the harmony of the fifth *sol* and that of the fifth *fa*.

176 The subject of dissonances continued.

98. The fifth *sol*, in rising above the generator, gives a chord entirely consisting of thirds ascending from *sol*, *sol, si, re, fa*; now the fifth *fa* being below the generator *ut* in descending, we shall find, as we go lower by thirds from *ut* towards *fa*, the same sounds *ut, la, fa, re*, which form the chord *fa, la, ut, re*, given to the fifth *fa*.

99. It appears besides, that the alteration of the harmony in the two fifths consists only in the third minor *re, fa*, which was reciprocally added to the harmony of these two fifths.

Chap. XII. *Of the Double Use or Employment of Dissonance.*

177 Account of the double employment.

100. It is evident by the resemblance of sounds to their octaves, that the chord *fa, la, ut, re*, is in effect the same as the chord *re, fa, la, ut*, taken inversely *, that the inverse of the chord *ut, la, fa, re*, has been found

* See *Inverted*.

(z) There are likewise other minor modes, into which we may pass in our egress from the mode major of *ut*; as that of *fa* minor, in which the perfect minor chord *fa, la*♭, *ut*, includes the sound *ut*, and whose scale in ascent *fa, sol, la*♭, *si*♭, *ut, re, mi, fa*, only includes the two sounds *la*♭, *si*♭, which do not occur in the scale of *ut*. We find an example of this transition from the mode major of *ut* to that of *fa* minor, in the opera of *Pygmalion* by M. Rameau, where the *sarabando* is in the minor mode of *fa*, and the *rigadoon* in the mode major of *ut*. This kind of transition, however, is not frequent.

The minor mode of *re* has only in its scale ascending *re, mi, fa, sol, la, si, ut*✻, *re*, one *ut* sharp which is not found in the scale of *ut*. For this reason a transition may likewise be made, without grating the ear, from the mode of *ut* major to the mode of *re* minor; but this passage is less immediate than the former, because the chords *ut, mi, sol, ut, re, fa, la, re*, not having a single sound in common, one cannot (art. 37.) pass immediately from the one to the other.

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found (art. 98.) in descending by thirds from the generator *ut* (AA).

178 Difference between dominant and tonic dominant.

101. The chord *re, fa, la, ut*, is a chord of the seventh like the chord *sol, si, re fa*: with this only difference, that in this the third *sol, si*, is major: whereas in the second, the third *re, fa*, is minor. If the *fa* were sharp, the chord *re, fa*♯, *la, ut*, would be a genuine chord of the dominant, like the chord *sol, si, re, fa*; and as the dominant *sol* may descend to *ut* in the fundamental bass, the dominant *re* implying or carrying with it the third major *fa*♯ might in the same manner descend to *sol*.

102. Now I say, that if the *fa*♯ should be changed into *fa* natural, *re*, the fundamental tone of this chord *re, fa, la, ut*, might still descend to *sol*; for the change from *fa*♯ to *fa* natural, will have no other effect, than to preserve the impression of the mode of *ut*, instead of that of the mode of *sol*, which the *fa*♯ would have here introduced. For what remains, the note *re* will always preserve its character as the dominant, on account of the mode of *ut*, which forms a seventh. Thus in the chord of which we treat, *re, fa, la, ut, re*, may be considered as an *imperfect dominant*; I call it *imperfect*, because it carries with it the third minor *fa*, instead of the third major *fa*♯. It is for this reason that in the sequel I shall call it simply the *dominant*, to distinguish it from the dominant *sol*, which shall be named the *tonic dominant*†.

† See *Dominant*.

103. Thus the sounds *fa* and *sol*, which cannot succeed each other (art. 36.) in a diatonic bass, when they only carry with them the perfect chords *fa, la, ut, sol, si, re*, may succeed one another if you join *re* to the harmony of the first, and *fa* to the harmony of the second; and if you invert the first chord, that is to say, if you give to the two chords this form, *re, fa, la, ut, sol, si, re, fa*.

179 Seeming contradictions reconciled.

104. Besides, the chord *fa, la, ut, re*, being allowed to succeed the perfect chord *ut, mi, sol, ut*, it follows for the same reasons, that the chord *ut, mi, sol, ut*, may be succeeded by *re, fa, la, ut*; which is not contradictory to what we have above said (art. 37.), that the sounds *ut* and *re* cannot succeed one another in the fundamental bass: for in the passage quoted, we had supposed that both *ut* and *re* carried with them a perfect chord mojor; whereas, in the present case, *re* carries the third minor *fa*, and likewise the sound *ut*, by which the chord *re fa la ut* is connected with that which precedes it *ut mi sol ut*; and in which the sound *ut* is found. Besides, this chord, *re fa la ut*, is properly nothing else but the chord *fa la ut re* inverted, and, if we may speak so, disguised.

180 Double employment, what, and why so called.

105. This manner of presenting the chord of the sub-dominant under two different forms, and of employing it under these two different forms, has been called by M. Rameau its *double office* or *employment*†. This is the source of one of the finest varieties in harmony; and we shall see in the following chapter the advantages which result from it.

† See *Double employment*.

We may add, that as this double employment is a kind of licence, it ought not to be practised without some precaution. We have lately seen that the chord *re fa la ut*, considered as the inverse of *fa la ut re*, may succeed to *ut mi sol ut*, but this liberty is not reciprocal: and though the chord *fa la ut re* may be followed by the chord *ut mi sol ut*, we have no right to conclude from thence that the chord *re fa la ut*, considered as the inverse of *fa la ut re*, may be followed by the chord *ut mi sol ut*. For this the reason shall be given CHAP. XVI.

CHAP. XIII. *Concerning the Use of this Double Employment, and its Rules.*

181 By the double use of the abovementioned chord, the impression of the mode may be preserved.

106. We have shown (chap. vi.) how the diatonic scale, or ordinary gammut, may be formed from the fundamental bass *fa, ut, sol, re*, by twice repeating the word *sol* in that series; so that this gammut is primitively and originally composed of two similar tetrachords, one in the mode of *ut*, the other in that of *sol*. Now it is possible, by means of this double employment, to preserve the impression of the mode of *ut* through the whole extent of the scale, without twice repeating the note *sol*, or even without supposing this repetition. For this effect we have nothing to do but form the following fundamental bass,

ut, sol, ut, fa, ut, re, sol, ut:

in which *ut* is understood to carry with it the perfect chord *ut mi sol ut*; *sol*, the chord *sol si re fa*; *fa*, the chord

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(AA) " M. Rameau, in several passages of his works (for instance, in p. 110, 111, 112, and 113, of the *Generation Harmonique)*, appears to consider the chord *re, fa, la, ut*, as the primary chord and generator of the chord *fa, la, ut, re*, which is nothing but that chord itself reversed; in other passages (particularly in p. 116. of the same performance), he seems to consider the first of these chords as nothing else but the reverse of the second. It would seem that this great artist has neither expressed himself upon this subject with so much uniformity nor with so much precision as is required. For my own part, I think there is some foundation for considering the chord *fa, la, ut, re*, as primitive: 1. Because in this chord, the fundamental and principal note is the sub-dominant *fa*, which ought in effect to be the fundamental and principal sound in the chord of the sub-dominant. 2. Because that without having recourse, with M. Rameau, to harmonical and arithmetical progressions, of which the consideration appears to us quite foreign to the question, we have found a probable and even a satisfactory reason for adding the note *re* to the harmony of the fifth *fa* (art. 96. and 97.) The origin thus assigned for the chord of the sub-dominant appears to us the most natural, though M. Rameau does not appear to have felt its full value; for scarcely has it been slightly insinuated by him."

Thus far our author. We do not enter with him into the controversy concerning the origin of the chord in question; but only propose to add to his definition of the sub-dominant Rousseau's idea of the same note. It is a name, says he, given by M. Rameau to the fourth note in any modulation relative to a given key, which of consequence is in the same interval from the key in descending as the dominant in rising; from which circumstance it takes its name.

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chord *fa la ut re*; and *re*, the chord *re fa la ut*. It is plain from what has been ſaid in the preceding chapter, that in this caſe *ut* may aſcend to *re* in the fundamental baſs, and *re* deſcend to *ſol*, and that the impreſſion of the mode of *ut* is preſerved by the *fa* natural, which forms the third minor *re fa*, inſtead of the third major which *re* ought naturally to imply.

107. This fundamental baſs will give, as it is evident, the ordinary diatonic ſcale,

ut, re, mi, fa, ſol, la, ſi, UT,

which of conſequence will be in the mode of *ut* alone; and if one ſhould chooſe to have the ſecond tetrachord in the mode of *ſol*, it will be neceſſary to ſubſtitute *fa*※ inſtead of *fa* natural in the harmony of *re* (BB).

108. Thus the generator *ut* may be followed according to pleaſure in aſcending diatonically either by a tonic dominant (*re fa*※ *la ut*), or by a ſimple dominant (*re fa la ut*).

109. In the minor mode of *la*, the tonic dominant *mi* ought always to imply its third major *mi ſol*※, when this dominant *mi* deſcends to the generator *la* (art. 83.); and the chord of this dominant ſhall be *mi ſol*※ *ſi re*, entirely ſimilar to *ſol ſi re fa*. With reſpect to the ſub-dominant *re*, it will immediately imply the third minor *fa*, to denominate the minor mode; and we may add *ſi* above its chord *re fa la*, in this manner *re fa la ſi*, a chord ſimilar to that of *fa la ut re*; and as we have deduced from the chord *fa la ut re* that of *re fa la ut*, we may in the ſame manner deduce from the chord *re fa la ſi* a new chord of the ſeventh *ſi re fa la*, which will exhibit the *double employment of diſſonances* in the minor mode.

110. One may employ this chord *ſi re fa la*, to preſerve the impreſſion of the mode of *la* in the diatonic ſcale of the minor mode, and to prevent the neceſſity of twice repeating the ſound *mi*; but in this caſe, the *fa* muſt be rendered ſharp, and change this chord to *ſi re fa*※ *la*, the fifth of *ſi* is *fa*※, as we have ſeen above; this chord is then the inverſe of *re fa*※ *la ſi*, where the ſubdominant implies the third major, which ought not to ſurpriſe us. For in the minor mode of *la*, the ſecond tetrachord *mi fa*※ *ſol*※ *la* is exactly the ſame as it would be in the major mode of *la*; now, in the major mode of *la*, the ſub-dominant *re* ought to imply the third major *fa*※.

182 Diverſities in the minor mode more numerous than in the major.

111. From thence we may ſee that the minor mode is ſuſceptible of a much greater number of varieties than the major; likewiſe the major mode is the product of nature alone; whereas the minor is, in ſome meaſure, the product of art. But in return, the major mode has received from nature, to which it owes its immediate formation, a force and energy which the minor cannot boaſt.

CHAP. XIV. *Of the Different Kinds of Chords of the Seventh.*

183 Inveſtigation whether art, in conſequence of ſome ſucceſsful advances, may not be carried farther.

112. THE diſſonance added to the chord of the dominant and of the ſub-dominant, though in ſome meaſure inſinuated by nature (chap. xi.), is nevertheleſs a work of art; but as it produces great beauties in harmony by the variety which it introduces into it, let us diſcover whether, in conſequence of this firſt advance, art may not ſtill be carried farther.

113. We have already three different kinds of chords of the ſeventh, *viz.*

184 Different chords of the ſeventh.

1. The chord *ſol ſi re fa*, compoſed of a third major followed by two thirds minor.

2. The chord *re fa la ut*, or *ſi re fa*※ *la*, compoſed of a third major between two minors.

3. The chord *ſi re fa la*, compoſed of two thirds minor followed by a major.

114. There are ſtill two other kinds of chords of the ſeventh which are employed in harmony; one is compoſed of a third minor between two thirds major, *ut mi ſol ſi*, or *fa la ut mi*; the other is wholly compoſed of thirds minor *ſol*※ *ſi re fa*. Theſe two chords, which at firſt appear as if they ought not to enter into harmony if we rigorouſly keep to the preceding rules, are nevertheleſs frequently practiſed with ſucceſs in the fundamental baſs. The reaſon is this:

185 The chords laſt deſcribed admiſſible, and why.

115. According to what has been ſaid above, if we would add a ſeventh to the chord *ut mi ſol*, to make a dominant of *ut*, one can add nothing but *ſi*♭; and in this caſe *ut mi ſol ſi*♭ would be the chord of the tonic dominant in the mode of *fa*, as *ſol ſi re fa* is the chord of the tonic dominant in the mode of *ut*; but if you would preſerve the impreſſion of the mode of *ut* in the harmony, you then change this *ſi*♭ into *ſi* natural, and the chord *ut mi ſol ſi*♭ becomes *ut mi ſol ſi*. It is the ſame caſe with the chord *fa la ut mi*, which is nothing elſe but the chord *fa la ut mi*♭; in which one may ſubſtitute for *mi*♭, *mi* natural, to preſerve the impreſſion of the mode of *ut*, or of that of *fa*.

Beſides, in ſuch chords as *ut mi ſol ſi*, *fa la ut mi*, the ſounds *ſi* and *mi*, though they form a diſſonance with

(BB) We need only add, that it is eaſy to ſee, that this fundamental baſs *ut ſol, ut fa, ut re, ſol ut*, which formed the aſcending ſcale *ut, re, mi, fa, ſol, la, ſi, UT*, cannot by inverting it, and taking it inverſely in this manner *ſi, ut, ſol, re, ut, fa, ut, ſol, UT*, form the diatonic ſcale *UT, ſi, la, ſol, fa, mi, re, ut*, in deſcent. In reality, from the chord *ſol, ſi, re, fa*, we cannot paſs to the chord *re, fa, la, ut*, nor from thence to *ut, mi, ſol, ut*. It is for this reaſon that in order to have the fundamental baſs of the ſcale, *UT, ſi, la, ſol, fa, mi, re, ut*, in deſcent, we muſt either determine to invert the fundamental baſs mentioned in art. 55. in this manner, *ut, ſol, re, ſol, ut, fa, ut, ſol, ut*, in which the ſecond *ſol* and the ſecond *ut* anſwer to the *ſol* alone in the ſcale; or otherwiſe we muſt form the fundamental baſs *ut, ſol, re, ſol, ut, ſol, ut*, in which all the notes imply perfect chords major, except the ſecond *ſol*, which implies the chord of the ſeventh *ſol, ſi, re, fa*, and which anſwers to the two notes of the ſcale *ſol, fa*, both comprehended in the chord *ſol, ſi, re, fa*.

Whichever of theſe two baſſes we ſhall chooſe, it is obvious that neither the one nor the other ſhall be wholly in the mode of *ut*, but in the mode of *ut* and in that of *ſol*. From whence it follows, that the double employment which gives to the ſcale a fundamental baſs all in the ſame mode when aſcending, cannot do the ſame in deſcending; and that the fundamental baſs of the ſcale in deſcending will be neceſſarily in two different modes.

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with *ut* in the first case, and with *fa* in the second, are nevertheless supportable to the ear, because these sounds *si* and *mi* (art. 19.) are already contained and understood, the first in the note *mi* of the chord *ut mi sol si*, as likewise in the note *sol* of the same chord; the second in the note *la* of the chord *fa la ut mi*, as likewise in the note *ut* of the same chord. All together then seem to allow the artist to introduce the note *si* and *mi* into these two chords (CC).

186 Chords of the seventh continued and explained.

116. With respect to the chord of the seventh *sol*♯ *si re fa*, wholely composed of thirds minor, it may be regarded as formed from the union of the two chords of the dominant and of the sub-dominant in the minor mode. In effect, in the minor mode of *la*, for instance, these two chords are *mi sol*♯ *si re*, and *re fa la si*, whose union produces *mi*, *sol*♯, *si*, *re*, *fa*, *la*. Now, if we should suffer this chord to remain thus, it would be disagreeable to the ear, by its multiplicity of dissonances, *re mi*, *mi la*, *la sol*♯, *la si*, *re sol*♯, (art. 18.); so that, to avoid this inconveniency, the generator *la* is immediately expunged, which (art. 19.) is as it were understood in *re*, and the fifth or dominant *mi* whose place the sensible note *sol*♯ is supposed to hold: thus there remains no more than the chord *sol*♯ *si re fa*, wholly composed of thirds minor, and in which the dominant *mi* is considered as understood; in such a manner that the chord *sol*♯ *si re fa* represents the chord of the tonic dominant *mi sol*♯ *si re*, to which we have joined the chord of the sub-dominant *re fa la si*, but in which the dominant *mi* is always reckoned the principal note (DD).

117. Since, then, from the chord *mi sol*♯ *si re*, we may pass to the perfect *la ut mi la*, and *vice versa*, we may in like manner pass from the chord *sol*♯ *si re fa* to the chord *la ut mi la*, and from this last to the chord *sol*♯ *si re fa*: this remark will be very useful to us in the sequel.

Chap. XV. *Of the Preparation of Discords.*

187 Dissonance, what.

118. In every chord of the seventh, the highest note, that is to say, the seventh above the fundamental, is called a *dissonance* or *discord*; thus *fa* is the dissonance of the chord *sol si re fa*, *ut* in the chord *re fa la ut*, &c.

188 Manner of preparing dissonances investigated.

119. When the chord *sol si re fa* follows the chord *ut mi sol ut*, as this may happen, and in reality often happens, it is obvious that we do not find the dissonance *fa* in the preceding chord *ut mi sol ut*. Nor ought it indeed to be found in that chord; for this dissonance is nothing else but the sub-dominant added to the harmony of the dominant to determine the mode: now, the sub-dominant is not found in the harmony of the generator.

120. For the same reason, when the chord of the sub-dominant *fa la ut re* follows the chord *ut mi sol ut*, the note *re*, which forms a dissonance with *ut*, is not found in the preceding chord.

It is not so when the chord *re fa la ut* follows the chord *ut mi sol ut*; for *ut*, which forms a dissonance in the second chord, stands as a consonance in the preceding.

121. In general, dissonance being the production of art (chap. xi.), especially in such chords as are not of the tonic dominant nor sub-dominant; the only means to prevent its displeasing the ear by appearing too heterogeneous to the chord, is, that it may be, if we may speak so, announced to the ear by being found in the preceding chord, and by that means serve to connect the two chords. From whence follows this rule: 189 Dissonance is only tolerable to the ear when found in preceding chords.

122. In every chord of the seventh, which is not the chord of the tonic dominant, that is to say, (art. 102.) which is not composed of a third major followed by two thirds minor, the dissonance which this chord forms ought to stand as a consonance in the chord which precedes it. 190 Preparation of dissonances how performed.

This is what we call a *prepared dissonance*. See Preparation.

123. From thence it follows, that in order to prepare a dissonance, it is absolutely necessary that the fundamental bass should ascend by the interval of a second, as

UT mi sol ut, *RE fa la ut*;

or descend by a third, as

UT mi sol ut, *LA ut mi sol*;

or descend by a fifth, as

UT mi sol ut, *FA la ut mi*:

in every other case the dissonance cannot be prepared. This is what may be easily ascertained. If, for instance, the fundamental bass rises by a third, as *ut mi sol ut*, *mi sol si re*, the dissonance *re* is not found in the chord *ut mi sol ut*. The same might be said of *ut mi sol ut*, *sol si re fa*, and *ut mi sol ut*, *si re fa la*, in which the fundamental bass rises by a fifth or descends by a second.

124. It may only be added, that when a tonic, that is to say, a note which carries with it a perfect chord, is followed by a dominant in the interval of a fifth or third, this procedure may be regarded as a process from that same tonic to another, which has been

(CC) On the contrary, a chord such as *ut mi*♭ *sol si*, in which *mi* would be flat, could not be admitted in harmony, because in this chord the *si* is not included and understood in *mi*♭. It is the same case with several other chords, such as *si re fa la*♯, *si re*♯ *fa la*, &c. It is true, that in the last of these chords, *la* is included in *fa*, but it is not contained in *re*♯; and this *re*♯ likewise forms with *fa* and with *la* a double dissonance, which, joined with the dissonance *si fa*, would necessarily render this chord not very pleasing to the ear; we shall yet, however, see in the second part, that this chord is sometimes used.

(DD) We have seen (art. 109.) that the chord *si re fa la*, in the minor mode of *la*, may be regarded as the inverse of the chord *re fa la si*; it would likewise seem, that, in certain cases, this chord *si re fa la* may be considered as composed of the two chords *sol si re fa*, *fa la ut re*, of the dominant and of the sub-dominant of the major mode of *ut*; which chords may be joined together, after having excluded from them, 1. The dominant *sol*, represented by its third major *si*, which is presumed to retain its place. 2. The note *ut* which is understood in *fa*, which will form this chord *si re fa la*. The chord *si re fa la*, considered in this point of view, may be understood as belonging to the major mode of *ut* upon certain occasions.

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been rendered a dominant by the addition of the dissonance.

Moreover, we have seen (art. 119. and 120.) that a dissonance does not stand in need of preparation in the chords of the tonic dominant and of the sub-dominant: from whence it follows, that every tonic carrying with it a perfect chord, may be changed into a tonic dominant (if the perfect chord be major), or into a subdominant (whether the chord be major or minor) by adding the dissonance all at once.

Chap. XVI. *Of the Rules for* resolving *Dissonances.*

191 Dissonances to be resolved, must be disguised and made to appear in the character of harmonics.

125. We have seen (chap. v. and vi.) how the diatonic scale, so natural to the voice, is formed by the harmonies of fundamental sounds; from whence it follows, that the most natural succession of harmonical sounds is to be diatonic. To give a dissonance then, in some measure, as much the character of an harmonic sound as may be possible, it is necessary that this dissonance, in that part of the modulation where it is found, should descend or rise diatonically upon another note, which may be one of the consonances of the subsequent chord.

192 In the chord of the tonic dominant, the dissonance should rather rise than descend, and why.

126. Now in the chord of the tonic dominant it ought rather to descend than to rise; for this reason. Let us take, for instance, the chord *sol si re fa* followed by the chord *ut mi sol ut;* the part which formed the dissonance *fa* ought to descend to *mi* rather than rise to *sol*, though both the sounds *mi* and *sol* are found in the subsequent chord *ut mi sol ut;* because it is more natural and more conformed to the connection which ought to be found in every part of the music, that *sol* should be found in the same part where *sol* has already been sounded, whilst the other part was sounding *fa*, as may be here seen (parts first and fourth.)

First part, - -	*fa mi,*
Second, - - -	*si ut,*
Third, - - -	*re ut,*
Fourth, - - -	*sol sol,*
Fundamental bass, - -	*sol ut.*

193 Consequences of the former rule.

127. For the same reason, in the chord of the simple dominant *re fa la ut*, followed by *sol si re fa*, dissonance *ut* ought rather to descend to *si* than rise to *re*.

194 Another consonance.

128. In short, for the same reason, we shall find, that in the chord of the sub-dominant *fa la ut re*, the dissonance *re* ought to rise to *mi* of the following chord *ut mi sol ut*, rather than descend to *ut;* whence may be deduced the following rules.

195 But is deduced from the former propositions.

129. 1°. In every chord of the dominant, whether tonic or simple, the note which constitutes the seventh, that is to say the dissonance, ought diatonically to descend upon one of the notes which form a consonance in the subsequent chord.

2°. In every chord of the subdominant, the dissonance ought to rise diatonically upon the third of the subsequent chord.

196 Dissonance resolved, what. See *Resolution.*

130. A dissonance which descends or rises diatonically according to these two rules, is called a *dissonance resolved.*

From these rules it is a necessary result, that the chord of the seventh *re fa la ut*, though one should even consider it as the inverse of *fa la ut re*, cannot be succeeded by the chord *ut mi sol ut*, since there is not in this last chord of *si* any note upon which the dissonance *ut* of the chord *re fa la ut* can descend.

One may besides find another reason for this rule, in examining the nature of the double employment of dissonances. In effect, in order to pass from *re fa la ut*, to *ut mi sol ut*, it is necessary that *re fa la ut* should in this case be understood as the inverse of *fa la ut re.* Now the chord *re fa la ut* can only be conceived as the inverse of *fa la ut re*, when this chord *re fa la ut* precedes or immediately follows the *ut mi sol ut;* in every other case the chord *re fa la ut* is a primitive chord, formed from the perfect minor chord *re fa la*, to which the dissonance *ut* was added, to take from *re* the character of a tonic. Thus the chord *re fa la ut*, could not be followed by the chord *ut mi sol ut*, but after having been preceded by the same chord. Now, in this case, the *double employment* would be entirely a futile expedient, without producing any agreeable effect; because, instead of this succession of chords, *ut mi sol ut, re fa la ut, ut mi sol ut*, it would be much more easy and natural to substitute this other, which furnishes this natural process, *ut mi sol ut, fa la ut re, ut mi sol ut.* The proper use of the double employment is, that, by means of inverting the chord of the sub-dominant, it may be able to pass from that chord thus inverted to any other chord except that of the tonic, to which it naturally leads.

Chap. XVII. *Of the Broken or Interrupted Cadence.*

131. In a fundamental bass which moves by fifths, there is always, as we have formerly observed (chap. viii.), a repose more or less perfect from one sound to another; and of consequence there must likewise be a repose more or less perfect from one sound to another in the diatonic scale, which results from that bass. It may be demonstrated by a very simple experiment, that the cause of a repose in melody is solely in the fundamental bass expressed or understood. Let any person sing these three notes *ut re ut*, performing on the *re* a shake, which is commonly called a *cadence;* the modulation will appear to him to be finished after the second *ut*, in such a manner that the ear will neither expect nor wish any thing to follow. The case will be the same if we accompany this modulation with its natural fundamental bass *ut sol ut:* but if, instead of this bass, we should give it the following, *ut sol la;* in this case the modulation *ut re ut* would not appear to be finished, and the ear would still expect and desire something more. This experiment may easily be made.

197 The test of perfection in cadences to be found in the fundamental bass.

132. This passage *sol la*, when the dominant *sol* diatonically ascends upon the note *la*, instead of descending by a fifth upon the generator *ut*, as it ought naturally to do, is called a *broken cadence;* because the perfect cadence *sol ut*, which the ear expected after the dominant *sol*, is, if we may speak so, broken and suspended by the transition from *sol* to *la*.

198 Broken cadences what, and why. See *Cadence.*

133. From thence it follows, that if the modulation *ut re ut* appeared finished when we supposed no bass to it at all, it is because its natural fundamental bass *ut sol ut* is supposed to be implied; because the ear desires something to follow this modulation, as soon as it is reduced to the necessity of hearing another bass.

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199 Origin of interrupted cadence in the double employment of dissonances.

134. The interrupted cadence may, as it seems to me, be considered as having its origin in the *double employment of dissonances*; since this cadence, like the double employment, only consists in a diatonic procedure of the bass ascending (chap. xii.) In effect, nothing hinders us to descend from the chord *sol si re fa* to the chord *ut mi sol la*, by converting the tonic *ut* into a sub-dominant, that is to say, by passing all at once from the mode of *ut* to the mode of *sol*: now to descend from *sol si re fa* to *ut mi sol la* is the same thing as to rise from the chord *sol si re fa* to the chord *la ut mi sol*, in changing the chord of the subdominant *ut mi sol la* for the imperfect chord of the dominant, according to the laws of the double employment.

200 Manner of performing this cadence.

135. In this kind of cadence, the dissonance of the first chord is resolved by descending diatonically upon the fifth of the subsequent chord. For instance, in the broken cadence *sol si re fa, la ut mi sol*, the dissonance *fa* is resolved by descending diatonically upon the fifth *mi*.

201 Interrupted cadence, what. See *Cadence*.

136. There is still another kind of cadence called an *interrupted cadence*, where the dominant descends by a third to another dominant, instead of descending by a fifth upon the tonic, as in this process of the bass, *sol si re fa, mi sol si re*; in the case of an interrupted cadence, the dissonance of the former chord is resolved by descending diatonically upon the octave of the fundamental note of the subsequent chord, as may be here seen, where *fa* is resolved upon the octave of *mi*.

202 Origin of this kind of cadence, likewise in the double employment.

137. This kind of interrupted cadence, as it seems to me, has likewise its origin in the double employment of dissonances. For let us suppose these two chords in succession, *sol si re fa, sol si re mi*, where the note *sol* is successively a tonic dominant and sub-dominant; that is to say, in which we pass from the mode of *ut* to the mode of *re*; if we should change the second of these chords into the chord of the dominant, according to the laws of the double employment, we shall have the interrupted cadence *sol si re fa, mi sol si re*.

Chap. XVIII. *Of the Chromatic Species.*

203 Fundamental bass may be formed by thirds major.

138. The series or fundamental bass by fifths produces the diatonic species in common use (chap. vi.): now the third major being one of the harmonics of a fundamental sound as well as the fifth, it follows, that we may form fundamental basses by thirds major, as we have already formed fundamental basses by fifths.

204 A chromatic interval or minor semitone, how found. *See fig.* K.

139. If then we should form this bass *ut, mi, sol*♯, the two first sounds carrying each along with it their thirds major and fifths, it is evident that *ut* will give *sol*, and that *mi* will give *sol*♯: now the semitone which is between this *sol* and this *sol*♯ is an interval much less than the semitone which is found in the diatonic scale between *mi* and *fa*, or between *si* and *ut*. This may be ascertained by calculation (EE): it is for this reason that the semitone from *mi* to *fa* is called *major*, and the other *minor* (FF).

140. If the fundamental bass should proceed by thirds minor in this manner, *ut, mi*♭, a succession which is allowed when we have investigated the origin of the minor mode (chap. ix.), we shall find this modulation *sol, sol*♭, which would likewise give a minor semitone (GG).

205 An intonation minor semitone difficult to be hit, and why.

141. The minor semitone is hit by young practitioners in intonation with more difficulty than the semitone major. For which this reason may be assigned: The semitone major which is found in the diatonic scale, as from *mi* to *fa*, results from a fundamental bass by fifths *ut fa*, that is to say, by a succession which is most natural, and for this reason the easiest to the ear. On the contrary, the minor semitone arises from a succession by thirds, which is still less natural than the former. Hence, that scholars may truly hit the minor semitone, the following artifice is employed. Let us suppose, for instance, that they intend to rise from *sol* to *sol*♯; they rise at first from *sol* to *la*, then descend from *la* to *sol*♯ by the interval of a semitone major; for this *sol* sharp, which is a semitone major below *la*, proves a semitone minor above *sol*. [See the notes (EE) and (FF).]

206 Minor semitone to be found in every procedure of the fundamental bass by thirds.

142. Every procedure of the fundamental bass by thirds, whether major or minor, rising or descending, gives the minor semitone. This we have already seen from the succession of thirds in ascending. The series of thirds minor in descending, *ut, la*, gives *ut, ut*♯ (HH);

(EE) In reality, *ut* being supposed 1, as we have always supposed it, *mi* is $\frac{4}{5}$, and *sol*♯ $\frac{25}{16}$: now *sol* being $\frac{3}{2}$, *sol*♯ then shall be to *sol* as $\frac{25}{16}$ to $\frac{3}{2}$; that is to say, as 25 times 2 to 3 times 16: the proportion then of *sol*♯ to *sol* is as 25 to 24, an interval much less than that of 16 to 15, which constitutes the semitone from *ut* to *si*, or from *fa* to *mi* (note L.)

(FF) It may be observed, that a minor joined to a major semitone will form a minor tone; that is to say, if one rises, for instance, from *mi* to *fa*, by the interval of a semitone major, and afterwards from *fa* to *fa*♯ by the interval of a minor semitone, the interval from *mi* to *fa*♯ will be a minor tone. For let us suppose *mi* to be 1, *fa* will be $\frac{16}{15}$, and *fa*♯ will be $\frac{25}{24}$ of $\frac{16}{15}$; that is to say, 25 times 16 divided by 24 times 15, or $\frac{10}{9}$; *mi* then is to *fa*♯ as 1 is to $\frac{10}{9}$, the interval which constitutes the minor tone (note N.)

With respect to the tone major, it cannot be exactly formed by two semitones; for, 1. Two major semitones in immediate succession would produce more than a tone major. In effect, $\frac{16}{15}$ multiplied by $\frac{16}{15}$ gives $\frac{256}{225}$, which is greater than $\frac{9}{8}$, the interval which constitutes (note N) the major tone. 2. A semitone minor and a semitone major would give less than a major tone, since they amount only to a true minor. 3. And, *à fortiori*, two minor semitones would give still less.

(GG) In effect, *mi*♭ being $\frac{6}{5}$, *sol*♭ will be $\frac{6}{5}$ of $\frac{6}{5}$; that is to say, (note C) $\frac{36}{25}$: now the proportion of $\frac{3}{2}$ to $\frac{36}{25}$ (note C) is that of 3 times 25 to 2 times 36; that is to say, as 25 to 24.

ory of mony. Theory of Harmony.

(HH); and the feries of thirds major in defcending, *ut*, *la*♭, gives *ut*, *ut*♭, (II).

207 e minor itone en pre- ent, ftitutes omatic fic.

143. The minor femitone conftitutes the fpecies called *chromatic;* and with the fpecies which moves by diatonic intervals, refulting from the fucceffion of fifths (chap. v. and vi.), it comprehends the whole of melody.

Chap. XIX. *Of the Enharmonic Species.*

208 fis or a mo- inter- , what, l how med. ec Fourth a Tone.

144. The two extremes, or higheft and loweft notes, *ut fol*✳, of the fundamental bafs by thirds major, *ut mi fol*✳, give this modulation *ut fi*✳; and thefe two founds *ut*, *fi*✳, differ between themfelves by a fmall interval which is called the *diefis*, or *enharmonic fourth* of a tone* (LL), which is the difference between a femitone major and a femitone minor (MM). This quarter tone is inappretiable by the ear, and impracticable upon feveral of our inftruments. Yet have means been found to put it in practice in the following manner, or rather to perform what will have the fame effect upon the ear.

209 anner of mingly roducing inter- upon truments fixed ks.

145. We have explained (art. 116.) in what manner the chord *fol*✳ *fi re fa* may be introduced into the minor mode, entirely confifting of thirds minor perfectly true, or at leaft fuppofed fuch. This chord fupplying the place of the coid of the dominant (art. 116.) from thence we may pafs to that of the tonic or generator *la* (art. 117.). But we muft remark,

1. That this chord *fol*✳ *fi re fa*, entirely confifting of thirds minor, may be inverted or modified according to the three following arrangements, *fi re fa fol*✳, *re fa fol*✳ *fi*, *fa fol*✳ *fi re;* and that in all thefe three

different ftates, it will ftill remain compofed of thirds minor; or at leaft there will only be wanting the enharmonic fourth of a tone to render the third minor between *fa* and *fol*✳ entirely juft; for a true third minor, as that from *mi* to *fol* in the diatonic fcale, is compofed of a femitone and a tone both major. Now from *fa* to *fol* there is a tone major, and from *fol* to *fol*✳ there is only a minor femitone. There is then awanting (art. 144.) the enharmonic fourth of a tone, to render the third *fa fol*✳ exactly true.

2. But as this divifion of a tone cannot be found in the gradations of any fcale practicable upon moft of our inftruments, nor be appretiated by the ear, the ear takes the different chords,

fi	*re*	*fa*	*fol*✳
re	*fa*	*fol*✳	*fi*,
fa	*fol*✳	*fi*	*re*,

which are abfolutely the fame, for chords compofed every one of thirds minor exactly juft.

Now the chord *fol*✳ *fi re fa*, belonging to the minor mode of *la*, where *fol*✳ is the fenfible note; the chord *fi re fa fol*✳, or *fi re fa la*♭, will, for the fame reafon, belong to the minor mode of *ut*, where *fi* is the fenfible note. In like manner, the chord *re fa fol*✳ *fi*, or *fi re fa la*♭ *ut*♭, will belong to the minor mode of *mi*♭, and the chord *fa fol*✳ *fi re*, or *fa la*♭ *ut*♭ *mi*♭♭, to the minor mode of *fol*♭.

After having paffed then by the mode of *la* to the chord *fol*✳ *fi re fa* (art. 117.), one may by means of this laft chord, and by merely fatisfying ourfelves to invert it, afterwards pafs all at once to the modes of *ut* minor, of *mi*♭ minor, or of *fol*♭ minor; that is to fay, into the modes which have nothing, or almoft nothing,

(HH) *La* being $\frac{5}{6}$, *ut*✳ is $\frac{5}{4}$ of $\frac{5}{6}$; that is to fay $\frac{25}{24}$, and *ut* is 1: the proportion then between *ut* and *ut*✳ is that of 1 to $\frac{25}{24}$, or of 24 to 25.

(II) *La*♭ being the third major below *ut*, will be $\frac{4}{5}$ (note c): *ut*♭, then, is $\frac{7}{5}$ of $\frac{4}{5}$; that is to fay $\frac{24}{25}$. The proportion, then, between *ut* and *ut*♭, is as 25 to 24.

(LL) *Sol*✳ being $\frac{25}{16}$ and *fi*✳ being $\frac{5}{4}$ of $\frac{25}{16}$, we fhall have *fi*✳ equal (note c) to $\frac{125}{64}$, and its octave below fhall be $\frac{125}{128}$; an interval lefs than unity by about $\frac{3}{128}$ or $\frac{1}{43}$. It is plain then from this fraction, that the *fi*✳ in queftion muft be confiderably lower than *ut*.

This interval has been called *the fourth of a tone*, and this denomination is founded on reafon. In effect, we may diftinguifh in mufic four kinds of quarter tones.

1. The fourth of a tone major: now, a tone major being $\frac{9}{8}$, and its difference from unity being $\frac{1}{8}$, the difference of this quarter tone from unity will be almoft the fourth of $\frac{1}{8}$; that is to fay, $\frac{1}{32}$.

2. The fourth of a tone minor; and as a tone minor, which is $\frac{10}{9}$, differs from unity by $\frac{1}{9}$, the fourth of a minor tone will differ from unity about $\frac{1}{36}$.

3. One half of a tone major; and as this femitone differs from unity by $\frac{1}{15}$, one half of it will differ from unity about $\frac{1}{30}$.

4. Finally, one half of a femitone minor, which differs from unity by $\frac{1}{24}$: its half then will be $\frac{1}{48}$.

The interval, then, which forms the enharmonic fourth of a tone, as it does not differ from unity but by $\frac{1}{43}$, may juftly be called the *fourth of a tone*, fince it is lefs different from unity than the largeft interval of a quarter tone, and more than the leaft.

We fhall add, that fince the enharmonic fourth of a tone is the difference between a femitone major and a femitone minor; and fince the tone minor is formed (note FF) of two femitones, one major and the other minor; it follows, that two femitones major in fucceffion form an interval larger than that of a tone by the enharmonic fourth of a tone; and that two minor femitones in fucceffion form an interval lefs than a tone by the fame fourth of a tone.

(MM) That is to fay, that if you rife from *mi* to *fa*, for inftance, by the interval of a femitone major, and afterwards, returning to *mi*, you fhould rife by the interval of a femitone minor to another found which is not in the fcale, and which I fhall mark thus, *fa*+, the two founds *fa*+ and *fa* will form the enharmonic fourth of a tone: for *mi* being 1, *fa* will be $\frac{16}{15}$; and *fa*+ $\frac{25}{24}$: the proportion then between *fa*+ and *fa* is that of $\frac{25}{24}$ to $\frac{16}{15}$ (note c); that is to fay, as 25 times 15 to 16 times 24; or otherwife, as 25 times 5 to 16 times 8, or as 125 to 128. Now this proportion is the fame which is found, in the beginning of the preceding note, to exprefs the enharmonic fourth of a tone.

nothing, in common with the minor mode of *la*, and which are entirely foreign to it (†).

210 The alteration, how ever, by which it is effectuated, abrupt and sensible.

146. It must, however, be acknowledged, that a transition so abrupt, and so little expected, cannot deceive nor elude the ear; it is struck with a sensation so unlooked-for without being able to account for the passage to itself. And this account has its foundation in the enharmonic fourth of a tone; which is overlooked as nothing, because it is inappretiable by the ear; but of which, though its value is not ascertained, the whole harshness is sensibly perceived. The instant of surprise, however, immediately vanishes; and that astonishment is turned into admiration, when one feels himself transported as it were all at once, and almost imperceptibly, from one mode to another, which is by no means relative to it, and to which he never could have immediately passed by the ordinary series of fundamental notes.

Chap. XX. *Of the Diatonic Enharmonic Species.*

147. If we form a fundamental bass, which rises alternately by fifths and thirds, as *fa*, *ut*, *mi*, *si*, this bass will give the following modulation, *fa*, *mi*, *mi*, *re*※; in which the semitones from *fa* to *mi*, and from *mi* to *re*※, are equal and major (NN).

See fig. M.

This species of modulation or of harmony, in which all the semitones are major, is called the *enharmonic diatonical* species. The major semitones peculiar to this species give it the name of *diatonic*, because major semitones belong to the diatonic species; and the tones which are greater than major by the excess of a fourth, resulting from a succession of major semitones, give it the name of *enharmonic* (note LL).

See *Enharmonic.*

Chap. XXI. *Of the Chromatic Enharmonic Species.*

211 Chromatic enharmonic intervals, how formed. *See fig.* N.

148. If we pass alternately from a third minor in descending to a third major in rising, as *ut*, *ut*, *la*, *ut*※, *ut*※, we shall form this modulation *mi*♭, *mi*, *mi*, *mi*, *mi*※, in which all the semitones are minor (OO).

This species is called the *chromatic enharmonical* species: the minor semitones peculiar to this kind give it the name of *chromatic*, because minor semitones belong to the chromatic species; and the semitones which are lesser by the diminution of a fourth resulting from a succession of minor semitones, give it the name of *enharmonic* (note LL).

212 From this species the effects of harmony and melody appear to be in the fundamental bass.

149. These new species confirm what we have all along said, that the whole effects of harmony and melody reside in the fundamental bass.

213 Diatonic species most agreeable and why.

150. The diatonic species is the most agreeable, because the fundamental bass which produces it is formed from a succession of fifths alone, which is the most natural of all others.

214 The chromatic next.

151. The chromatic being formed from a succession of thirds, is the most natural after the preceding.

215 Lastly, the enharmonic.

152. Finally, the enharmonic is the least agreeable of all, because the fundamental bass which gives it is not immediately indicated by nature. The fourth of a tone which constitutes this species, and which is itself inappretiable to the ear, neither produces nor can produce its effect, but in proportion as imagination suggests the fundamental bass from whence it results; a bass whose procedure is not agreeable to nature, since it is formed of two sounds which are not contiguous one to the other in the series of thirds (art. 144.)

Chap. XXII. *Showing that Melody is the Offspring of Harmony.*

216 The effects of melody to be investigated in harmony expressed or understood.

153. All that we have hitherto said, as it seems to me, is more than sufficient to convince us, that melody has its original principle in harmony; and that it is in harmony, expressed or understood, that we ought to look for the effects of melody.

154. If this should still appear doubtful, nothing more is necessary than to pay due attention to the first experiment (art. 19.), where it may be seen that the principal sound is always the lowest, and that the sharper sounds which it generates are with relation to it what the treble of an air is to its bass.

155. Yet more, we have proved, in treating of broken cadence (chap. xvii.), that the diversification of basses

(†) As this method for obtaining or supplying enharmonic gradations cannot be practised on every occasion when the composer or practitioner would wish to find them, especially upon instruments where the scale is fixed and invariable, except by a total alteration of their œconomy, and re-tuning the strings, Dr Smith in his Harmonics has proposed an expedient for redressing or qualifying this defect, by the addition of a greater number of keys or strings, which may divide the tone or semitone into as many appretiable or sensible intervals as may be necessary. For this, as well as for the other advantageous improvements which he proposes in the structure of instruments, we cannot with too much warmth recommend the perusal of his learned and ingenious book to such of our readers as aspire to the character of genuine adepts in the theory of music.

(NN) It is obvious, that if *fa* in the bass be supposed 1, *fa* of the scale will be 2, *ut* of the bass $\frac{3}{2}$, and *mi* of the scale $\frac{5}{4}$ of $\frac{3}{2}$, that is, $\frac{15}{8}$; the proportion of *fa* to *mi* is as 2 to $\frac{15}{8}$, or as 1 to $\frac{15}{16}$. Now *mi* of the bass being likewise $\frac{5}{4}$ of $\frac{3}{2}$, or $\frac{15}{8}$; *si* of the bass is $\frac{3}{2}$ of $\frac{15}{8}$, and its third major *re*※ $\frac{5}{4}$ of $\frac{3}{2}$ of $\frac{15}{8}$, or $\frac{15}{8}$ of $\frac{15}{8}$; this third major, approximated as much as possible to *mi* in the scale by means of octaves, will be $\frac{15}{16}$ of $\frac{15}{8}$: *mi* then of the scale will be to *re*※ which follows it, as $\frac{15}{8}$ is to $\frac{15}{16}$ of $\frac{15}{8}$, that is to say, as 1 to $\frac{15}{16}$. The semitones then from *fa* to *mi*, and from *mi* to *re*※, are both major.

(OO) It is evident that *mi*♭ is $\frac{6}{5}$ (note C), and that *mi* is $\frac{5}{4}$: these two *mi*'s, then, are between themselves as $\frac{6}{5}$ to $\frac{5}{4}$, that is to say, as 6 times 4 to 5 times 5, or as 24 to 25, the interval which constitutes the minor semitone. Moreover, the *la* of the bass is $\frac{5}{6}$, and *ut*※ $\frac{5}{4}$ of $\frac{5}{6}$, or $\frac{25}{24}$: *mi*※ then is $\frac{5}{4}$ of $\frac{25}{24}$, the *mi* in the scale is likewise to the *mi*※ which follows it, as 24 to 25. All the semitones therefore in this scale are minor.

ory of mony. basses produces effects totally different in a modulation which, in other respects, remains the same.

156. Can it be still necessary to adduce more convincing proofs? We have nothing to do but examine the different basses which may be given to this very simple modulation *sol, ut;* of which it will be found susceptible of a great many, and each of these basses will give a different character to the modulation *sol ut,* though in itself it remains always the same; in such a manner that we may change the whole nature and effects of a modulation, without any other alteration except that of changing its fundamental bass.

M. Rameau has shown, in his *New System of Music,* printed at Paris 1726, p. 44. that this modulation *sol ut,* is susceptible of 20 different fundamental basses. Now the same fundamental bass, as may be seen in our second part, will afford several continued or thorough basses. How many means, of consequence, may be practised to vary the expression of the same modulation?

217 nsequen- deduci- from s prin- le. 157. From these different observations it may be concluded, 1. That an agreeable melody, naturally implies a bass extremely sweet and adapted for singing; and that reciprocally, as musicians express it, a bass of this kind generally prognosticates an agreeable melody (PP).

2. That the character of a just harmony is only to form in some measure one system with the modulation, so that from the whole taken together the ear may only receive, if we may speak so, one simple and indivisible impression. Theory of Harmony.

3. That the character of the same modulation may be diversified, according to the character of the bass which is joined with it.

But notwithstanding the dependency of melody upon harmony, and the sensible influence which the latter may exert upon the former; we must not however from thence conclude, with some celebrated musicians, that the effects of harmony are preferable to those of melody. Experience proves the contrary. [See, on this account, what is written on the licence of music, printed in tom. iv. of D'Alembert's *Melanges de Literature,* p. 448.]

General Remark.

The diatonic scale or gammut being composed of twelve semitones, it is clear that each of these semitones taken by itself may be the generator of a mode; and that thus there must be twenty-four modes in all, twelve major and twelve minor. We have assumed the major mode of *ut,* to represent all the major modes in general, and the minor mode of *la* to represent the modes minor, to avoid the difficulties arising from sharps and flats, of which we must have encountered either a greater or lesser number in the other modes. But the rules we have given for each mode are general, whatever note of the gammut be taken for the generator of a mode.

Part II. Principles and Rules of COMPOSITION.

218 mposi- , in har- ny, a . : Com- ition. 158. Composition, which is likewise called *counterpoint,* is not only the art of composing an agreeable air, but also that of composing a great many airs in such a manner that when heard at the same time, they may unite in producing an effect agreeable and delightful to the ear; this is what we call *composing music in several parts.*

The highest of these parts is called the *treble,* the lowest is termed the *bass;* the other parts, when there are any, are termed *middle parts;* and each in particular is signified by a different name.

Chap. I. *Of the Different Names given to the same Interval.*

219 rticular e vals nified by fe ent mes, and y. 159. In the introduction (art. 9.), which is at the front of this treatise, we have seen a detail of the most common names which are given to the different intervals. But there are particular intervals which have obtained different names, according to particular circumstances; which it is proper to explain.

220 cond re- ndant, at. 160. An interval composed of a tone and a semitone, which is commonly called a *third minor,* is likewise sometimes called a *second redundant;* such is the interval from *ut* to *re*✳ in ascending, or that of *la* to *sol*♭ descending.

This interval is so termed, because one of the sounds which form it is always either sharp or flat, and that, if you deduce that sharp or that flat, the interval will be that of a second. 221 Why so called.

161. An interval composed of two tones and two semitones, as that from *si* to *fa,* is called a *false fifth.* This interval is the same with the *triton* (art. 9.), since two tones and two semitones are equivalent to three tones. There are, however, some reasons for distinguishing them, as will appear below. 222 False fifth, what.

162. As the interval from *ut* to *re*✳ in ascending has been called a second redundant, they likewise call the interval from *ut* to *sol*✳ in ascending a *fifth redundant,* or from *si* to *mi*♭ in descending, each of which intervals are composed of four tones. 223 Fifth redundant, what.

This interval is, in the main, the same with that of the sixth minor (art. 6.): but in the fifth redundant there is always a sharp or a flat; insomuch, that if this sharp or flat were deduced, the interval would become a true fifth. 224 Distinguished from the sixth minor.

163. For the same reason, an interval composed of three tones and three semitones, as from *sol*✳ to *fa* in ascending, 225 Seventh diminished, what.

(PP) There are likewise several eminent musicians, who in their compositions, if we can depend on what has been affirmed, begin with determining and writing the bass. This method, however, appears in general more proper to produce a learned and harmonious music, than a strain prompted by genius and animated by enthusiasm.

Principles of Compoſition.

226 Seventh major and redundant coincident.

aſcending, is called a *ſeventh diminiſhed;* becauſe, if you deduce the ſharp from *ſol*, the interval from *ſol* to *fa* will become that of an ordinary ſeventh. The interval of a ſeventh diminiſhed is in other reſpects the ſame with that of the ſixth major (art. 9.)

164. The major ſeventh is likewiſe ſometimes called a *ſeventh redundant* (QQ.)

Chap. II. *Compariſon of the Different Intervals.*

227 Notes in different octaves or ſcales replications each of the other.

165. If we ſing *ut ſi* in deſcending by a ſecond, and afterwards *ut ſi* in aſcending by a ſeventh, theſe two *ſi*'s ſhall be octaves one to the other; or, as we commonly expreſs it, they will be *replications* one of the other.

228 Hence to deſcend to one replication, and riſe to another, has the ſame effect.

166. On account then of the reſemblance between every ſound and its octave (art. 22.), it follows, that *to riſe by a ſeventh*, or *deſcend by a ſecond*, amount to one and the ſame thing.

167. In like manner, it is evident that the ſixth is nothing but a replication of the third, nor the fourth but a replication of the fifth.

229 Detail of replications.

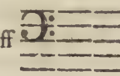
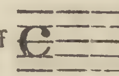
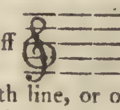
168. The following expreſſions either are or ought to be regarded as ſynonymous.

230 Examples of this.

To riſe To deſcend	by a ſecond.	To deſcend To riſe	by a ſeventh.
To riſe To deſcend	by a third.	To deſcend To riſe	by a ſixth.
To riſe To deſcend	by a fourth.	To deſcend To riſe	by a fifth.

169. Thus, therefore, we ſhall employ them indifferently the one for the other; ſo that when we ſay, for inſtance, *to riſe by a third*, it may be ſaid with equal propriety *to deſcend by a ſixth*, &c.

Chap. III. *Of the different Cleffs; of the Value or Quantity; of the Rithmus; and of Syncopation.*

170. There are three cleffs * in muſic; the cleff of *fa* 𝄢, or 𝄢; the cleff *ut* 𝄡; and the cleff of *ſol* 𝄞. But, in Britain, the following characters are uſed: The F, or baſs-cleff ; the C, or tenor cleff ; and the G, or treble cleff . 231 Cleffs, what,

* See Cleff.

The cleff of *fa* is placed on the fourth line, or on the third; and the line upon which this cleff is placed gives the name of *fa* or *F*, to all the notes which are upon that line. 232 And how placed. See fig. O.

The cleff of *ut* is placed upon the fourth, the third, the ſecond, or the firſt line; and in theſe different poſitions all the notes upon that line where the cleff is placed take the name of *ut*, or *C*. See fig. P. See fig. Q.

Laſtly, the cleff of *ſol* is placed upon the ſecond or firſt line; and all the notes upon that line where the cleff is placed take the name of *ſol*, or *G*.

233 Names of notes to be inveſtigated from the poſition of the cleffs. See fig. O.

171. As the notes are placed on the lines, and in the ſpaces between the lines, any one, when he ſees the cleff, may eaſily find the name of any note whatever. Thus he may ſee, that, in the firſt cleff of *fa*, the note which is placed on the loweſt line ought to be *ſol*; that the note which occupies the ſpace between the two firſt lines ſhould be *la*; and that the note which is on the ſecond line is a *ſi*, &c. (RR).

5 172. A

(QQ) The chief uſe of theſe different denominations is to diſtinguiſh chords: for inſtance, the chord of the redundant fifth and that of the diminiſhed ſeventh are different from the chord of the ſixth; the chord of the ſeventh redundant, from that of the ſeventh major. This will be explained in the following chapters.

(RR) It is on account of the different compaſſes of voices and inſtruments that theſe cleffs have been invented.

The maſculine voice, which is the loweſt, may at its greateſt depth, without ſtraining, deſcend to *ſol*, which is in the laſt line of the firſt cleff of *fa*; and the female voice, which is the ſharpeſt, may at its higheſt pitch riſe to a *ſol*, which is a triple octave above the former.

The loweſt of maſculine voices is adapted to a part which may be called a *mean baſs*, and its cleff is that of *fa* on the fourth line; this cleff is likewiſe that of the violoncello and of the deepeſt inſtruments. A mean baſs extremely deep is called a *baritonus* or *counter-baſs*.

The maſculine voice which is next in depth to what we have called the *mean baſs* may be termed the *concordant baſs*. Its cleff is that of *fa* on the third line.

The maſculine voice which follows the *concordant baſs* may be denominated a *tenor*; a voice of this pitch is the moſt common, yet ſeldom extremely agreeable. Its cleff is that of *ut* on the fourth line. This cleff is alſo that of the baſſoon or baſs-hautboy.

The higheſt maſculine voice of all may be called *counter tenor*. Its cleff is that of *ut* on the third line. It is likewiſe the cleff of tenor violins, &c.

The deepeſt female voice immediately follows the counter tenor, and may be called *baſs in alt*. Its cleff is that of *ut* upon the firſt line. The cleff of *ut* upon the ſecond line is not in frequent uſe.

The ſharpeſt female voice is called *treble*; its cleff is that of *ſol* on the ſecond line.

This laſt cleff, as well as that of *ſol* on the firſt line, is likewiſe the cleff of the ſharpeſt inſtruments, ſuch as the violin, the flute, the trumpet, the hautboy, the flagelet, &c.

The *ut* which may be ſeen in the cleffs of *fa* and in the cleffs of *ut* is a fifth above the *fa* which is on the line of the cleff of *fa*; and the *ſol* which is on the two cleffs of *ſol* is a fifth above *ut*: inſomuch that *ſol* which is

Principles of Compoſition.

234 Marks and powers of ſharps, flats, and naturals, what.

172. A note before which there is a ſharp (marked thus ♯) ought to be raiſed by a ſemitone; and if, on the contrary, there is a ♭ before it, it ought to be depreſſed by a ſemitone, (♭ being the mark of a flat).

The natural (marked thus ♮) reſtores to its natural value a note which had been raiſed or depreſſed by a ſemitone.

See fig. R.

173. When you place at the cleff a ſharp or a flat, all the notes upon the line on which this ſharp or flat is marked are ſharp or flat. Thus let us take, for inſtance, the cleff of *ut* upon the firſt line, and let us place a ſharp in the ſpace between the ſecond and third line, which is the place of *fa*; all the notes which ſhall be marked in that ſpace will be *fa*♯; and if you would reſtore them to their original value of *fa* natural, you muſt place a ♮ or a ♭ before them.

See fig. S.

In the ſame manner, if a flat be marked at the cleff, and if you would reſtore the note to its natural ſtate, you muſt place a ♮ or a ♯ before it.

See fig. X.

235 Bars and times, what.

174. Every piece of muſic is divided into different equal times, which they call *meaſures* or *bars*; and each bar is likewiſe divided into different times.

See Time.

There are properly two kinds of meaſures or modes of time (*See* T): the meaſure of two times, or of common time, which is marked by the figure 2 placed at the beginning of the tune; and the meaſure of three times, or of triple time, which is marked by the figure 3 placed in the ſame manner. (*See* V.)

The different bars are diſtinguiſhed by perpendicular lines.

In a bar we diſtinguiſh between the *perfect* and *imperfect* time; the *perfect* time is that which we *beat*, the *imperfect* that in which we *lift up the hand or foot*. A bar conſiſting of four times ought to be regarded as compounded of two bars, each conſiſting of two times: thus there are in this bar two perfect and two imperfect times. In general, by the words *perfect* and *imperfect*, even the parts of the ſame time are diſtinguiſhed: thus the firſt note of each time is reckoned as belonging to the *perfect* part, and the others as belonging to the *imperfect*. See fig. Y.

236 The value of notes in duration.

175. The longeſt of all notes is a ſemibreve. A minim is half its value; that is to ſay, in ſinging, we only employ the ſame duration in performing two minims which was occupied in one ſemibreve. A minim in the ſame manner is equivalent to two crotchets, the crotchet to two quavers, &c.

237 Syncopation, what.

176. A note which is divided into two parts by a time, that is to ſay, which begins at the end of a time, and terminates in the time following, is called (ss) a *ſyncopated note*. (*See* Z; where the notes *ut*, *ſi*, and *la*, are each of them ſyncopated.) (†). See Syncopation.

177. A

is on the loweſt line of the firſt cleff of *fa*, is lower by two whole octaves than the *ſol* which is on the loweſt line of the ſecond cleff of *ſol*.

[Thus far the tranſlator has followed his original as accurately as poſſible; but this was by no means an eaſy taſk. Among all the writers on muſic which he has found in Engliſh, there is no ſuch thing as different names for each particular part which is employed to conſtitute full or complete harmony. He was therefore under a neceſſity of ſubſtituting by analogy ſuch names as appeared moſt expreſſive of his author's meaning. To facilitate this attempt, he examined in Rouſſeau's muſical dictionary the terms by which the different parts were denominated in D'Alembert; but even Rouſſeau, with all his depth of thought and extent of erudition, inſtead of expreſſing himſelf with that preciſion which the ſubject required, frequently applies the ſame names indiſcriminately to different parts, without aſſigning any reaſon for this promiſcuous and licentious uſe of words. The Engliſh reader therefore will be beſt able to form an accurate idea of the different parts, by the nature and ſituation of the cleffs with which they are marked; and if he ſhould find any impropriety in the names which are given them, he may adopt and aſſociate others more agreeable to his ideas.]

(ss) Syncopation conſiſts in a note which is protracted in two different times belonging partly to the one and partly to the other, or in two different bars; yet not ſo as entirely to occupy or fill up the two times, or the two bars. A note, for inſtance, which begins in the imperfect time of a bar, and which ends in the perfect time of the following, or which in the ſame bar begins in the imperfect part of one time and ends in the perfect of the following, is ſyncopated. A note which of itſelf occupies one or two bars, whether the meaſure conſiſts of two or three times, is not conſidered as ſyncopated: this is a conſequence of the preceding definition. This note is ſaid to be *continued* or *protracted*. In the end of the example Z, the *ut* of the firſt bar conſiſting of three times is not ſyncopated, becauſe it occupies two whole times. It is the ſame caſe with *mi* of the ſecond bar, and with the *ut* of the fourth and fifth. Theſe therefore are continued or protracted notes.

(†) *Times* and *bars* in muſic anſwer the very ſame end as punctuation in language. They determine the different periods of the movement, or the various degree of completion, which the ſentiment, expreſſed by that movement, has attained. Let us ſuppoſe, for inſtance, a compoſer in muſic intending to expreſs grief or joy, in all its various gradations, from its firſt and fainteſt ſenſation, to its acme or higheſt poſſible degree. We do not ſay that ſuch a progreſs of any paſſion either has been or can be delineated in practice, yet it may ſerve to illuſtrate what we mean to explain. Upon this hypotheſis, therefore, the degrees of the ſentiment will paſs from leſs to more ſenſible, as it riſes to its moſt intenſe degree. The firſt of theſe gradations may be called a *time*, which is likewiſe the moſt convenient diviſion of a bar or meaſure into its elementary or aliquot parts, and may be deemed equivalent to a comma in a ſentence; a bar denotes a degree ſtill more ſenſible, and may be conſidered as having the force of a ſemicolon; a ſtrain brings the ſentiment to a tolerable degree of perfection, and may be reckoned equal to a colon: the full period is the end of the imitative piece. It muſt have been remarked by obſervers of meaſure in melody or harmony, that the notes of which a bar or meaſure conſiſts, are not diverſified by their different durations alone, but likewiſe by greater or leſſer degrees of emphaſis.

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238 Value of a pointed note.

177. A note followed by a point or dot is increaſed half its value. The *ſi*, for inſtance, in the fifth bar of the example Y, followed by a point, has the value (*) or duration of a minim and of a crotchet at the ſame time.

Chap. IV. *Containing a Definition of the principal Chords.*

239 Perfect chords, what.

178. The chord compoſed of a third, a fifth, and an octave, as *ut mi ſol ut*, is called a *perfect chord* (art. 32.)

If the third be major, as in *ut mi ſol ut*, the perfect chord is denominated *major:* if the third be minor, as in *la ut mi la*, the perfect chord is minor. The perfect chord major conſtitutes what we call the *major mode;* and the perfect chord minor, what we term the *minor mode* (art. 31).

240 Chord of the ſeventh, what, and how to be practiſed.

179. A chord compoſed of a third, a fifth, and a ſeventh, as *ſol ſi re fa*, or *re fa la ut*, &c. is called a *chord of the ſeventh*. It is obvious that ſuch a chord is wholly compoſed of thirds in aſcending.

All chords of the ſeventh are practiſed in harmony, ſave that which might carry the third minor and the ſeventh major, as *ut mi*♭ *ſol ſi;* and that which might carry a falſe fifth and a ſeventh major, as *ſi re fa la*✻, (chap. xiv. Part I)

241 Thoſe of different kinds.

180. As thirds are either major or minor, and as they may be differently arranged, it is clear that there are different kinds of chords of the ſeventh; there is even one, *ſi re fa la*, which is compoſed of a third, a falſe fifth, and a ſeventh.

242 Of the greater ſixth, what.

181. A chord compoſed of a third, a fifth, and a ſixth, as *fa la ut re, re fa la ſi*, is called a *chord of the greater ſixth*.

182. Every note which carries a perfect chord is called a *tonic*, and a perfect chord is marked by an 8, by a 3, or by a 5, which is written above the note; but frequently theſe numbers are ſuppreſſed. Thus in the example I. the two *ut*'s equally carry a perfect chord.

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243 Tonic, what, and its chords, how figured.

244 Dominant, what, and how figured.

183. Every note which carries a chord of the ſeventh is called a *dominant* (art. 102); and this chord is marked by a 7 written above the note. Thus in the example II. *re* carries the chord *re fa la ut*, and *ſol* the chord *ſol ſi re fa*.

It is neceſſary to remark, that among the chords of the ſeventh we do not reckon the chord of the ſeventh diminiſhed, which is only improperly called a *chord of the ſeventh;* and of which we ſhall ſay more below.

[244] Sub-dominant, what, and how figured.

184. Every note which carries the chord of the great ſixth, is called a *ſubdominant*, (art. 97, and 42.) and is marked with a 6. Thus in the example III. *fa* caries the chord of *fa la ut re*. You ought to remark that the ſixth ſhould always be major, (art. 97, and 109).

245 Fundamental note, what. See *Fundamental*.

185. In every chord, whether perfect, or a chord of the ſeventh, or of the great ſixth, the note which carries this chord, and which is the flatteſt or loweſt, is called the *fundamental note*. Thus *ut* in the example I. *re* and *ſol* in the example II. and *fa* in the example III. are fundamental notes.

246 Diſſonance of a chord, what.

186. In every chord of the ſeventh, and of the great ſixth, the note which forms the ſeventh or ſixth above the fundamental, that is to ſay, the higheſt note of the chord, is called a *diſſonance*. Thus in the chords of the ſeventh *ſol ſi re fa, re fa la ut, fa* and *ut* are the diſſonances, viz. *fa* with relation to *ſol* in the firſt chord, and *ut* with relation to *re* in the ſecond. In the chord of the great ſixth *fa la ut re*, *re* is the diſſonance (art. 120.); but that *re* is only, properly

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phaſis. The moſt emphatic parts of a bar are called the *accented parts;* thoſe which require leſs energy in expreſſion are called the *unaccented*. The ſame obſervation holds with regard to times as bars. The ſtroke, therefore, of the hand or foot in beating marks the accented part of the bar, the elevation or preparation for the ſtroke marks the unaccented part. Let us once more reſume our compoſition intended to expreſs the different periods in the progreſs of grief or joy. There are ſome revolutions in each of theſe ſo rapid as not to be marked by any ſenſible tranſition whether diatonic or conſonant. In this caſe, the moſt expreſſive tone may be continued from one part of a time or meaſure to another, and end before the period of that time or meaſure in which it begins. Here therefore is a natural principle upon which the practice of ſyncopation may be founded even in melody: but when muſic is compoſed in different parts to be ſimultaneouſly heard, the continuance of one note not divided by regular times and meaſures, nor beginning and ending with either of them, whilſt the other parts either aſcend or deſcend according to the regular diviſions of the movement, has not only a ſenſible effect in rendering the imitation more perfect, but even gives the happieſt opportunities of diverſifying the harmony, which of itſelf is a moſt delightful perception.

For the various diſpoſitions of accent in times and meaſures, according to the movement of any piece, ſee a Treatiſe on Muſic by Alexander Malcolm.

For the opportunity of diverſifying harmony afforded by ſyncopation, ſee Rameau's Principles of Compoſition.

(*) To prevent ambiguity or confuſion of ideas, it is neceſſary to inform our readers, that we have followed M. D'Alembert in his double ſenſe of the word *value*, though we could have wiſhed he had diſtinguiſhed the different meanings by different words. A ſound may be either eſtimated by its different degrees of intenſeneſs, or by its different quantities of duration.

To ſignify both thoſe ideas the word *value* is employed by D'Alembert. The reader, therefore, will find it of importance to diſtinguiſh the value of a note in height from its value in duration. This he may eaſily do, by conſidering whether the notes are treated as parts of the diatonic ſcale, or as continued for a greater or leſſer duration.

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properly speaking, a dissonance with relation to *ut* from which it is a *second*, and not with respect to *fa* from which it is a *sixth major* (art. 17, and 18).

247 Tonic and simple dominant, what.

187. When a chord of the seventh is composed of a third major followed by two thirds minor, the fundamental note of this chord is called the *tonic dominant*. In every other chord of the seventh the fundamental is called the *simple dominant* (art. 102.). Thus in the chord *sol si re fa*, the fundamental *sol* is the *tonic dominant*; but in the other chords of the seventh, as *ut mi sol si*, *re fa la ut*, &c. the fundamentals *ut* and *re* are *simple dominants*.

248 Major chords, how rendered minor, and vice versa.

188. In every chord, whether perfect, or of the seventh, or of the sixth, if you have a mind that the third above the fundamental note should be major, though it is naturally minor, you must place a sharp above the fundamental note. For example, if I would mark the perfect major chord *re fa*※ *la re*, as the third *fa* above *re* is naturally minor, I place above *re* a sharp, as you may see in example IV. In the same manner the chord of the seventh *re fa*※ *la ut*, and the chord of the great sixth *re fa*※ *la si*, is marked with a ※ above *re*, and above the ※ a 7 or a 6 (see V. and VI.).

On the contrary, when the third is naturally major, and if you should incline to render it minor, you must place above the fundamental note a ♭. Thus the examples VII. VIII. IX. show the chords *sol si*♭ *re sol*, *sol si*♭ *re fa*, *sol si*♭ *re mi* (TT).

Chap. V. *Of the Fundamental Bass.*

249 Fundamental bass, how formed.

189. Invent a modulation at your pleasure; and under this modulation let there be set a bass composed of different notes, of which some may carry a perfect chord, others that of the seventh, and others that of the great sixth, in such a manner that each note of the modulation which answers to each of the bass, may be one of those which enters into the chord of that note in the bass; this bass being composed according to the rules which shall be immediately given, will be the *fundamental bass* of the modulation proposed. See Part I. where *the nature and principles of the fundamental bass* are explained.

See *Fundamental bass*.

Thus (Exam. XVIII.) you will find that this modulation, *ut re mi fa sol la si ut*, has or may admit for its fundamental bass, *ut* $\overset{7}{sol}$ *ut* $\overset{6}{fa}$ *ut* $\overset{7}{re}$ $\overset{7}{sol}$ *ut*.

In reality, the first note *ut* in the upper part is found in the chord of the first note *ut* in the bass, which chord is *ut mi sol ut*; the second note *re* in the treble is found in the chord *sol si re fa*, which is the chord of the second note in the bass, &c. and the bass is composed only of notes which carry a perfect chord, or that of the seventh, or that of the great sixth. Moreover, it is formed according to the rules which we are now about to give.

Chap. VI. *Rules for the Fundamental Bass.*

190. All the notes of the fundamental bass being only capable of carrying a perfect chord, or the chord of the seventh, or that of the great sixth, are either tonics, or dominants, or sub-dominants; and the dominants may be either simple or tonic. 250 Rules for the formation of this bass.

The fundamental bass ought always to begin with a tonic, as much as it is practicable. And now follow the rules for all the succeeding chords; rules which are evidently derived from the principles established in the *First Part* of this treatise. To be convinced of this, we shall find it only necessary to review the articles 34, 91, 122, 124, 126, 127.

Rule I.

191. In every chord of the tonic, or of the tonic dominant, it is necessary that at least one of the notes which form that chord should be found in the chord that precedes it.

Rule II.

192. In every chord of the simple dominant, it is necessary

(TT) We may only add, that there is no occasion for marking these sharps or flats when they are originally placed at the cleff. For instance, if the sharp be upon the cleff of *fa* (see Exam. X.), one may satisfy himself with simply writing *re*, without a sharp to mark the perfect chord major of *re*, *re fa*※ *la re*. In the same manner, in the Example XI. where the flat is at the cleff upon *si*, one may satisfy himself with simply writing *sol*, to mark the perfect chord minor of *sol si*♭ *re sol*.

But if a case occurs where there is a sharp or a flat at the cleff, if any one should wish to render the chord minor which is major, or *vice versa*, he must place above the fundamental note a ♮ or natural. Thus the Example XII. marks the minor chord *re fa la re*, and Example XIII. the major chord *sol si re sol*.— Frequently, in lieu of a natural, a flat is used to signify the minor chord, and a sharp to signify the major. Thus Example XIV. marks the minor chord *re fa la re*, and Example XV. the major chord *sol si re sol*.

When in a chord of the great sixth, the dissonance, that is to say, the sixth, ought to be sharp, and when the sharp is not found at the cleff, they write before or after the 6 a ※; and if this sixth should be flat according to the cleff, they write a ♮.

In the same manner, if in a chord of the seventh of the tonic dominant, the dissonance, that is to say, the seventh, ought to be flat or natural, they write by the side of the seventh a ♭ or a ♮. Many musicians, when a seventh from the simple dominant ought to be altered by a sharp or a natural, have likewise written by the side of the seventh a ※ or a ♮; but M. Rameau suppresses these characters. The reason shall be given below, when we speak of chords by supposition.

If there be a sharp on the cleff of *fa*, and if I should incline to mark the chord *sol si re fa*, or the chord *la ut mi fa*, I would place before the seventh or the sixth a ♮ or a ♭.

In the same manner, if there be a flat on the cleff at *si*, and if I should incline to mark the chord *ut mi sol si*, I would place before the seventh a ※ or a ♮; and so of the rest.

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neceſſary that the note which conſtitutes the ſeventh, or diſſonance, ſhould likewiſe be found in the preceding chord.

Rule III.

193. In every chord of the ſub-dominant, at leaſt one of its conſonances muſt be found in the preceding chord. Thus, in the chord of the ſub-dominant *fa la ut re*, it is neceſſary that *fa*, *la*, or *ut*, which are the conſonances of the chord, ſhould be found in the chord preceding. The diſſonance *re* may either be found in it or not.

Rule IV.

194. Every ſimple or tonic dominant ought to deſcend by a fifth. In the firſt caſe, that is to ſay, when the dominant is ſimple, the note which follows can only be a dominant; in the ſecond it may be any one you chooſe; or, in other words, it may either be a tonic, a tonic dominant, a ſimple dominant, or a ſub-dominant. It is neceſſary, however, that the conditions preſcribed in the ſecond rule ſhould be obſerved, if it be a ſimple dominant.

This laſt reflection is neceſſary, as you will preſently ſee. For let us aſſume the ſucceſſion of the two chords *la ut※ mi ſol, re fa la ut* (ſee Exam. XIX.), this ſucceſſion is by no means legitimate, though in it the firſt dominant deſcends by a fifth; becauſe the *ut* which forms the diſſonance in the ſecond chord, and which belongs to a ſimple dominant, is not in the preceding chord. But the ſucceſſion will be admiſſible, if, without meddling with the ſecond chord, one ſhould take away the ſharp carried by the *ut* in the firſt; or if, without meddling with the firſt chord, one ſhould render *ut* or *fa* ſharp in the ſecond (UU); or in ſhort, if one ſhould ſimply render the *re* of the ſecond chord a tonic dominant, in cauſing it to carry *fa※* inſtead of *fa* natural (119. & 122.).

It is likewiſe by the ſame rule that we ought to reject the ſucceſſion of the two following chords,

re fa la ut, ſol ſi re fa※;

(ſee Exam. XX.).

Rule V.

195. Every ſub-dominant ought to riſe by a fifth; and the note which follows it may, at your pleaſure, be either a tonic, a tonic dominant, or a ſub-dominant.

REMARK.

251 Other rules ſubſtituted. Of the five fundamental rules which have now been given, inſtead of the three firſt, one may ſubſtitute

the three following, which are nothing but conſequences from them, and which you may paſs unnoticed if you think it proper.

Rule I.

If a note of the fundamental baſs be a tonic, and riſe by a fifth or a third to another note, that ſecond note may be either a *tonic* (34. & 91.), ſee Examples XXI. and XXII. (XX); a *tonic dominant* (124.), ſee XXIII. and XXIV.; or a *ſub-dominant* (124.), ſee XXV. and XXVI.; or, to expreſs the rule more ſimply, that ſecond note may be any one you pleaſe, except a *ſimple dominant*.

Rule II.

If a note of the fundamental baſs be a tonic, and deſcend by a fifth or a third upon another note, this ſecond note may be either a tonic (34. & 91.), ſee Exam. XXVII. and XXVIII.; or a tonic dominant, or a ſimple dominant, yet in ſuch a manner that the rule of art. 192. may be obſerved (124.), ſee XXIX. XXX. XXXI. XXXII.; or a ſub-dominant (124.), ſee XXXIII. and XXXIV.

The procedure of the baſs *ut mi♭ ſol ut, fa la ut mi*, from the tonic *ut* to the dominant *fa* (Ex. XXXV.), is excluded by art. 192.

Rule III.

If a note in the fundamental baſs be a tonic, and riſe by a ſecond to another note, that note ought to be a tonic dominant, or a ſimple dominant (101. & 102.). See XXXVI. and XXXVII. (YY).

We muſt here advertiſe our readers, that the examples XXXVIII. XXXIX. XL. XLI. belong to the fourth rule above, art. 194.; and the examples XLII. XLIII. XLIV. to the fifth rule above, art. 195. See the articles 34, 35, 121, 123, 124.

REMARK I.

196. The tranſition from a tonic dominant to a tonic is called an *abſolute repoſe*, or a *perfect cadence* (73.); and the tranſition from a ſub-dominant to a tonic is called an *imperfect* or *irregular cadence* (73.); the cadences are formed at the diſtance of four bars one from another, whilſt the tonic then falls within the firſt time of the bar. See XLV. and XLVI. 252 Perfect and imperfect cadences, what, and how employed.

REMARK II.

197. We muſt avoid, as much as we can, ſyncopations in the fundamental baſs; that, within the firſt time of which a bar is conſtituted, the ear may be entertained with a harmony different from that which it had 253 Syncopation only admiſſible in the fundamental baſs by licence.

(UU) In this chord it is neceſſary that the *ut* and *fa* ſhould be ſharp at the ſame time; for the chord *re fa la ut※*, in which *ut* would be ſharp without the *fa*, is excluded by art. 179.

(XX) When the baſs riſes or deſcends from one tonic to another by the interval of a third, the mode is commonly changed; that is to ſay, from a major it becomes a minor. For inſtance, if I aſcend from the tonic *ut* to the tonic *mi*, the major mode of *ut*, *ut mi ſol ut*, will be changed into the minor mode of *mi*, *mi ſol ſi mi*. For what remains, we muſt never aſcend from one tonic to another, when there is no ſound common to both their modes: for example, you cannot riſe to the mode of *ut*, *ut mi ſol ut*, from the minor mode of *mi♭*, *mi♭ ſol♭ ſi♭ mi♭* (91.)

(YY) By this we may ſee, that all the intervals, viz. the third, the fifth, and ſecond, may be admitted in the fundamental baſs, except that of a ſecond in deſcending. For what remains, it is very proper to remark, that the rules immediately given for the fundamental baſs are not without exception, as approved compoſitions in muſic will certainly diſcover; but theſe exceptions being in reality licences, and for the moſt part in oppoſition to the great principle of connection, which preſcribes that there ſhould be at leaſt one note in common between a preceding and a ſubſequent chord, it does not ſeem neceſſary to entertain initiates with a minute detail of theſe licences in an elementary work, where the firſt and moſt eſſential rules of the art alone ought to be expected.

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had before perceived in the laſt time of the preceding bar. Neverthelefs, ſyncopation may be ſometimes admitted in the fundamental baſs, but it is by a licence (zz).

Chap. VII. *Of the Rules which ought to be obſerved in the Treble with relation to the Fundamental Baſs.*

254 Definition of treble.

198. The treble is nothing elſe but a modulation above the fundamental baſs, and whoſe notes are found in the chords of that baſs which correſponds with it (189.). Thus in Ex. XVIII. the ſcale *ut re mi fa ſol la ſi ut*, is a treble with reſpect to the fundamental baſs *ut ſol ut fa ut re ſol ut*.

255 One note in the treble or baſs may anſwer to ſeveral of its correſpondent parts, and why.

199. We are juſt about to give the rules for the treble; but firſt we think it neceſſary to make the two following remarks.

1. It is obvious, that many notes of the treble may anſwer to one and the ſame note in the fundamental baſs, when theſe notes belong to the chord of the ſame note in the fundamental baſs. For example, this modulation *ut mi ſol mi ut*, may have for its fundamental baſs the note *ut* alone, becauſe the chord of that note comprehends the ſounds *ut*, *mi*, *ſol*, which are found in the treble.

2. In like manner, a ſingle note in the treble may, for the ſame reaſon, anſwer to ſeveral notes in the baſs. For inſtance, *ſol* alone may anſwer to theſe three notes in the baſs, *ut ſol ut* (aaa).

Rule I. *for the Treble.*

200. If the note which forms the ſeventh in a chord of the *ſimple dominant* is found in the treble, the note which precedes it muſt be the very ſame. This is what we call a *diſcord prepared* (122). For inſtance, let us ſuppoſe that the note of the fundamental baſs ſhall be *re*, bearing the chord of the ſimple dominant *re fa la ut*; and that this *ut*, which (art. 18. and 118.) is the diſſonance, ſhould be found in the treble; it is neceſſary that the note which goes before it in the treble ſhould likewiſe be an *ut*.

201. And it is requiſite to obſerve, that, according to the rules which we have given for the fundamental baſs, *ut* will always be found in the chord of that note in the fundamental baſs which precedes the ſimple dominant *re*. See XLVIII. XLIX. L. In the firſt example the diſſonance is *ut*, in the ſecond *ſol*, and in the third *mi*; and theſe notes are already in the preceding chord (bbb).

Rule II.

202. If a note of the fundamental baſs be a tonic dominant, or a ſimple dominant, and if the diſſonance be found in the treble, this diſſonance in the ſame treble ought to deſcend diatonically. But if the note of

(zz) There are notes which may be found ſeveral times in the fundamental baſs in ſucceſſion with a different harmony. For inſtance, the tonic *ut*, after having carried the chord *ut mi ſol ut*, may be followed by another *ut* which carries the chord of the ſeventh, provided that this chord be the chord of the tonic dominant *ut mi ſol ſi*♭. See LXXII. In the ſame manner, the tonic *ut* may be followed by the ſame tonic *ut*, which may be rendered a *ſub-dominant*, by cauſing it to carry the chord *ut mi ſol la*. See LXXIII.

A dominant, whether tonic or ſimple, ſometimes deſcends or riſes upon one another by the interval of a tritone or falſe fifth. For example, the dominant *fa*, carrying the chord *fa la ut mi*, may be followed by another dominant *ſi*, carrying the chord *ſi re fa la* This is a licence in which the muſician indulges himſelf, that he may not be obliged to depart from the ſcale in which he is; for inſtance, from the ſcale of *ut* to which *fa* and *ſi* belong. If one ſhould deſcend from *fa* to *ſi*♭ by the interval of a juſt fifth, he would then depart from that ſcale, becauſe *ſi*♭ is no part of it.

(aaa) There are often in the treble ſeveral notes which may, if we chooſe, carry no chord, and be regarded merely as notes of paſſage, ſerving only to connect between themſelves the notes that do carry chords, and to form a more agreeable modulation. Theſe notes of paſſage are commonly quavers. See Exam. XLVII. in which this modulation *ut re mi fa ſol*, may be regarded as equivalent to this other, *ut mi ſol*, as *re* and *fa* are no more than notes of paſſage. So that the baſs of this modulation may be ſimply *ut ſol*.

When the notes are of equal duration, and arranged in a diatonic order, the notes which occupy the perfect part of each time, or thoſe which are accented, ought each of them to carry chords. Thoſe which occupy the imperfect part, or which are unaccented, are no more than mere notes of paſſage. Sometimes, however, the note which occupies the imperfect part may be made to carry harmony; but the value of this note is then commonly increaſed by a point which is placed after it, which proportionably diminiſhes the continuance of the note that occupies the perfect time, and makes it paſs more ſwiftly.

When the notes do not move diatonically, they ought generally all of them to enter into the chord which is placed in the lower part correſpondent with theſe notes.

(bbb) There is, however, one caſe in which the ſeventh of a ſimple dominant may be found in a modulation without being prepared. It is when, having already employed that dominant in the fundamental baſs, its ſeventh is afterwards heard in the modulation, as long as this dominant may be retained. For inſtance, let us imagine this modulation,

	ut |	*re*	*ut*	*ſi*	*ut* |	*re*;
and this fundamental baſs,	*ut* |	$\overset{7}{re}$		$\overset{7}{ſol}$	*ut* |	$\overset{7}{ſol}$

(ſee Example LI.); the $\overset{7}{re}$ of the fundamental baſs anſwers to the two notes *re ut* of the treble. The diſſonance *ut* has no need of preparation, becauſe the note $\overset{7}{re}$ of the fundamental baſs having already been employed for the *re* which precedes *ut*, the diſſonance *ut* is afterwards preſented, below which the chord *re* may be preſerved, or *re fa la ut*.

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of the bafs be a fub-dominant, it ought to rife diatonically. This diffonance, which rifes or defcends diatonically, is what we have called a *diffonance faved* or *refolved* (129, 130.). See LII. LIII. LIV.

203. One may likewife obferve here, that, according to the rules for the fundamental bafs which we have given, the note upon which the diffonance ought to defcend or rife will always be found in the fubfequent chord (ccc).

Chap. VIII. *Of the Continued Bafs, and its Rules.*

* See *Continued bafs.*

256 Thorough-bafs, what.

204. A continued * or thorough bafs, is nothing elfe but a fundamental bafs whofe chords are *inverted.* We invert a chord when we change the order of the notes which compofe it. For example, if inftead of the chord *fol fi re fa*, I fhould fay *fi re fa fol*, or *re fa fol fi*, &c. the chord is inverted. Let us fee then, in the firft place, all the poffible ways in which a chord may be inverted.

257 Chords inverted, how.

The ways in which a Perfect Chord may be Inverted.

205. The perfect chord *ut mi fol ut* may be inverted in two different ways.

1. *Mi fol ut mi*, which we call a chord of the *fixth*, compofed of a third, a fixth, and an octave, and in this cafe the note *mi* is marked with a 6. (See LVI.)

2. *Sol ut mi fol*, which we call a *chord of the fixth and fourth*, compofed of a fourth, a fixth, and an octave; and it is marked with a $^6_4$. (See LVII.)

The perfect minor chord is inverted in the fame manner.

The ways in which the Chord of the Seventh may be Inverted.

206. In the chord of the tonic dominant, as *fol fi re fa*, the third major *fi* above the fundamental note *fol* is called a *fenfible note* (77.); and the inverted chord *fi re fa fol*, compofed of a third, a falfe fifth, and fixth, is called the *chord of the falfe fifth*, and is marked with an 8 or a ♭5 (fee LVIII. and LIX.)

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The chord *re fa fol fi*, compofed of a third, a fourth, and a fixth, is called the *chord of the fenfible fixth*, and marked with a 6 or a ※6. In this chord thus figured, the third is minor, and the fixth major, as it is eafy to be perceived. (See LX.)

The chord *fa fol fi re*, compofed of a fecond, a tritone, and a fixth, is called the *chord of the tritone*, and is marked thus 4+, thus ×4, or thus ※4. (See LXI.)

207. In the chord of the fimple dominant *re fa la ut*, we find,

1. *Fa la ut re*, a chord of the great fixth, which is compofed of a third, a fifth, and a fixth, and which is figured with a $^6_5$. See LXIII. (ddd).

2. *La ut re fa*, a chord of the leffer fixth, which is figured with a 6. See LXIV. (eee).

3. *Ut re fa la*, a chord of the fecond, compofed of a fecond, a fourth, and a fixth, and which is marked with a 2. See LXII. (fff).

The ways in which the Chord of the fub-dominant may be inverted.

208. The chord of the fub-dominant, as *fa la ut re*, may be inverted in three different manners; but the method of inverting it which is moft in practice is the chord of the leffer fixth *la ut re fa*, which is marked with a 6, and the chord of the feventh *re fa la ut*. See LXIV.

Rules for the Continued Bass.

209. The continued bafs is a fundamental bafs, whofe chords are only inverted in order to render it more in the tafte of finging, and fuitable to the voice. See LXV. in which the fundamental bafs which in itfelf is monotonic and little fuited for finging, *ut fol ut fol ut fol ut*, produces, by inverting its chords, this continued

(ccc) When the treble fyncopates in defcending diatonically, it is common enough to make the fecond part of the fyncope carry a difcord, and the firft a concord. See *Example* LV. where the firft part of the fyncopated note *fol* is in concord with the notes *ut mi fol ut*, which anfwer to it in the fundamental bafs, and where the fecond part is a diffonance in the fubfequent chord *la ut mi fol*. In the fame manner, the firft part of the fyncopated note *fa* is in concord with the notes *re fa la ut*, which anfwer to it; and the fecond part is a diffonance in the fubfequent chord *fol fi re fa*, which anfwer to it, &c.

(ddd) We are obliged to mark likewife, in the continued bafs, the chord of the fub-dominant with a $^6_5$, which in the fundamental bafs is figured with a 6 alone; and this to diftinguifh it from the chords of the fixth and of the leffer fixth. (See Examples LVI. and LXIV.) For what remains, the chord of the great fixth in the fundamental bafs carries always the fixth major, whereas in the continued bafs it may carry the fixth minor. For inftance, the chord of the feventh *ut mi fol fi*, gives the chord of the great fixth *mi fol fi ut*, thus improperly called, fince the fixth from *mi* to *ut* is minor.

(eee) M. Rameau has juftly obferved, that we ought rather to figure this leffer fixth with a $^3_4$, to diftinguifh it from the fenfible fixth which arifes from the chord of the tonic dominant, and from the fixth which arifes from the perfect chord. In the mean time he figures in his works with a 6 alone, the leffer fixths which do not arife from the tonic dominant; that is to fay, he figures them as thofe which arife from the perfect chord; and we have followed him in that, though we thought with him, that it would be better to mark this chord by a particular figure.

(fff) The chord of the feventh *fi re fa la* gives, when inverted, the chord *fa la fi re*, compofed of a third, a tritone, and a fixth. This chord is commonly marked with a 6, as if the tritone were a juft fourth. It is his bufinefs who performs the accompaniment, to know whether the fourth above *fa* be a tritone or a fourth redundant. One may, as to what remains, figure this chord thus $\begin{smallmatrix}6\\4*\\3\end{smallmatrix}$.

tinued bafs highly proper to be fung, *ut fi ut re mi fa mi*, &c. (GGG.)

The continued bafs then is properly nothing elfe but a treble with refpect to the fundamental bafs. Its rules immediately follow, which are properly no other than thofe already given for the treble.

RULE I.

210. Every note which carries the chord of the falfe fifth, and which of confequence muft be what we have called a *fenfible note*, ought (77) to rife diatonically upon the note which follows it. Thus in example LXV. the note *fi*, carrying the chord of the falfe fifth marked with an 8, rifes diatonically upon *ut* (HHH).

RULE II.

211. Every note carrying the chord of the tritone fhould defcend diatonically upon the fubfequent note. Thus in the fame example LXV. *fa*, which carries the chord of the tritone figured with a 4+, defcends diatonically upon *mi*. (Art. 202.)

RULE III.

212. The chord of the fecond is commonly put in practice upon notes which are fyncopated in defcending, becaufe thefe notes are diffonances which ought to be prepared and refolved (200, 202.) See the example LXVI. where the fecond *ut*, which is fyncopated, and which defcends afterwards upon *fi*, carries the chord of the fecond (III).

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(GGG) The continued bafs is proportionably better adapted to finging, as the founds which form it more fcrupuloufly obferve the diatonic order, becaufe this order is the moft agreeable of all. We muft therefore endeavour to preferve it as much as poffible. It is for this reafon that the continued bafs in Example LXV. is much more in the tafte of finging, and more agreeable, than the fundamental bafs which anfwers to it.

(HHH) The continued bafs being a kind of treble with relation to the fundamental bafs, it ought to obferve the fame rules with refpect to that bafs as the treble. Thus a note, for inftance *re*, carrying a chord of the feventh *re fa la ut*, to which the chord of the fub-dominant *fa la ut re* correfponds in the fundamental bafs, ought to rife diatonically upon *mi*, (art. 129, n° 2. and art. 202.)

(III) When there is a *repofe* in the treble, the note of the continued bafs ought to be the fame with that of the fundamental bafs, (fee example LXVII.) In the clofes which are found in the treble at *fi* and *ut* (bars third and fourth), the notes in the fundamental and continued bafs are the fame, viz. *fol* for the firft cadence, and *ut* for the fecond. This rule ought above all to be obferved in final cadences which terminate a piece or a modulation.

It is neceffary, as much as poffible, to prevent coincidences of the fame notes in the treble and continued bafs, unlefs the motion of the continued bafs fhould be contrary to that of the treble. For example, in the fecond note of the fecond bar in example LXVII. *mi* is found at the fame time in the continued bafs and in the treble; but the treble defcends from *fa* to *mi*, whilft the bafs rifes from *re* to *mi*.

Two octaves, or two fifths, in fucceffion, muft likewife be fhunned. For inftance, in the treble founds *fol mi*, the bafs muft be prevented from founding *fol mi*, *ut la*, or *re fi*, becaufe in the firft cafe there are two octaves in fucceffion, *fol* againft *fol*, and *mi* againft *mi*; and becaufe in the fecond cafe there are two fifths in fucceffion, *ut* againft *fol*, and *la* againft *mi*, or *re* againft *fol*, and *fi* againft *mi*. This rule, as well as the preceding, is founded upon this principle, that the continued bafs ought not to be a copy of the treble, but to form a different melody.

Every time that feveral notes of the continued bafs anfwer to one note alone of the fundamental, the compofer fatisfies himfelf with figuring the firft of them. Nay he does not even figure it if it be a tonic; and he draws above the others a line, continued from the note upon which the chord is formed. See example LXVIII. where the fundamental bafs *ut* gives the continued bafs *ut mi fol mi*; the two *mi*'s ought in this bafs to carry the chord 6, and *fol* the chord $\frac{6}{4}$: but as thefe chords are comprehended in the perfect chord *ut mi fol ut*, which is the firft of the continued bafs, we place nothing above *ut*, only we draw a line over *ut mi fol mi*.

In like manner, in the fecond bar of the fame example, the notes *fa* and *re* of the continued bafs, rifing from the note *fol* alone of the fundamental bafs which carries the chord *fol fi re fa*, we think it fufficient to figure *fa* with the number of the tritone 4×, and to draw a line above *fa* and *re*.

It fhould be remarked, that this *fa* ought naturally to defcend to *mi*; but this note is confidered as fubfifting fo long as the chord fubfifts; and when the chord changes, we ought neceffarily to find the *mi*, as may be feen by that example.

In general, whilft the fame chord fubfifts in paffing through different notes, the chord is reckoned the fame as if the firft note of the chord had fubfifted; in fuch a manner, that, if the firft note of the chord is, for inftance, the fenfible note, we ought to find the tonic when the chord changes. See example LXIX. or this continued bafs, *ut fi fol fi re ut*, is reckoned the fame with this *ut fi ut*. (Example LXX.)

If a fingle note of the continued bafs anfwers to feveral notes of the fundamental bafs, it is figured with the different chords which agree to it. For example, the note *fol* in a continued bafs may anfwer to this fundamental bafs *ut fol ut*, (fee example LXXI.); in this cafe, we may regard the note *fol* as divided into three parts, of which the firft carries the chord $\frac{6}{4}$, the fecond the chord 7, and the third the chord $\frac{6}{4}$.

We fhall repeat here, with refpect to the rules of the continued bafs, what we have formerly faid concerning the rules of the fundamental bafs in the note upon the third rule, art. 193. The rules of the continued bafs have exceptions, which practice and the perufal of good authors will teach. There are likewife feveral other rules which might require a confiderable detail, and which will be found in the *Treatife of Harmony* by M. Rameau, and elfewhere. Thefe rules, which are proper for a complete differtation, did not appear to me indifpenfably neceffary in an *elementary effay upon mufic*, fuch as the prefent. The books which we have quoted at the end of our *preliminary difcourfe* will more particularly inftruct the reader concerning this practical detail.

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Chap. IX. *Of ſome Licences aſſumed in the Fundamental Baſs.*

§ 1. *Of* Broken *and* Interrupted Cadences.

258 Broken cadence, how executed. 213. The broken cadence is executed by means of a dominant which riſes diatonically upon another, or upon a tonic by a licence. See, in the example LXXIV. *ſol la*, (132, and 134).

259 Interrupted cadence, how formed. 214. The interrupted cadence is formed by a dominant which deſcends by a third upon another (136). See, in the example LXXV. *ſol mi* (LLL).

Theſe cadences ought to be permitted but rarely and with precaution.

§ 2. *Of* Supposition.

260 Chord by ſuppoſition, what. 215. When a dominant is preceded by a tonic in the fundamental baſs, we add ſometimes, in the continued baſs to the chord of that dominant, a new note which is a third or a fifth below; and the chord which reſults from it in this continued baſs is called *a chord by ſuppoſition*.

See *Suppoſition*.

For example, let us ſuppoſe, that in the fundamental baſs we have a dominant *ſol* carrying the chord of the ſeventh *ſol ſi re fa*; let us add to this chord the note *ut*, which is a fifth below this dominant, and we ſhall have the total chord *ut ſol ſi re fa*, or *ut re fa ſol ſi*, which is called *a chord by ſuppoſition* (MMM.)

Of the different kinds of chords by ſuppoſition.

216. It is eaſy to perceive, that chords by ſuppoſition are of different kinds. For inſtance, the chord of the tonic *ſol ſi re fa* gives,

261 Theſe different chords what, and how figured.

1. By adding the fifth *ut*, the chord *ut ſol ſi re fa*, called a *chord of the ſeventh redundant*, and compoſed of a fifth, ſeventh, ninth, and eleventh. It is figured with a ※ 7; ſee LXXVI. (NNN). This chord is not practiſed but upon the tonic. They ſometimes leave out the ſenſible note, for reaſons which we ſhall give in the note QQQ, upon the art. 219; it is then reduced to *ut fa ſol re*, and marked with $^{5}_{4}$ or $^{5}_{2}$.

2. By adding the third *mi*, we ſhall have the chord *mi ſol ſi re fa*, called a *chord of the ninth*, and compoſed of a third, fifth, ſeventh, and ninth. It is figured with a 9. This third may be added to every third of the dominant. See LXXVII. (OOO).

3. If to a chord of the ſimple dominant, as *re fa la ut*, we ſhould add the fifth *ſol*, we would have the chord *ſol re fa la ut*, called a *chord of the eleventh*, and which is figured with a $^{9}_{4}$ or $^{4}_{9}$. (See LXXVIII.)

Observe.

262 Occaſions when retrenchments of chords are proper.

217. When the dominant is not a tonic dominant, they often take away ſome notes from the chord. For example, let us ſuppoſe that there is in the fundamental baſs this ſimple dominant *mi*, carrying the chord *mi ſol ſi re*: if there ſhould be added the third *ut* beneath, we ſhall have this chord of the continued baſs *ut mi ſol ſi re*, but they ſuppreſs the ſeventh *ſi*, for reaſons which ſhall be explained in the note QQQ upon art.

(LLL) One may ſometimes, but very rarely, cauſe ſeveral tonics in ſucceſſion to follow one another in aſcending or deſcending diatonically, as *ut mi ſol ut, re fa la re, ſi♭ re fa ſi♭*; but, beſides that this ſucceſſion is harſh, it is neceſſary, in order to render it practicable, that the fifth below the firſt tonic ſhould be found in the chord of the tonic following, as here *fa*, a fifth below the firſt tonic *ut*, is found in the chord *re fa la re*, and in the chord *ſi♭ re fa ſi♭* (37 and note G.)

(MMM) Though ſuppoſition be a kind of licence, yet it is in ſome meaſure founded on the experiment related in the note (F), where you may ſee that every principal or fundamental ſound cauſes its twelfth and ſeventeenth major in deſcending to vibrate, whilſt the twelfth and the ſeventeenth major aſcending reſound: which ſeems to authorize us in certain caſes to join with the fundamental harmony this twelfth and ſeventeenth in deſcending; or, which is the ſame thing, the fifth or the third beneath the fundamental ſound.

Even without having recourſe to this experiment, we may remark, that the note added beneath the fundamental ſound, cauſes that very fundamental ſound to be heard. For inſtance, *ut* added beneath *ſol*, cauſes *ſol* to reſound. Thus *ſol* is found in ſome meaſure to be implied in *ut*.

If the third added beneath the fundamental ſound be minor, for example, if to the chord *ſol ſi re fa*, we add the third *mi*, the ſuppoſition is then no longer founded on the experiment, which only gives the ſeventeenth major, or, what is the ſame thing, the third major beneath the fundamental ſound. In this caſe the addition of the third minor muſt be conſidered as an extenſion of the rule, which in reality has no foundation in the chords emitted by a ſonorous body, but is authorized by the ſanction of the ear and by practical experiment.

(NNN) Many muſicians figure this chord with a ※$^{7}_{2}$; M. Rameau ſuppreſſes this 2, and merely marks it to be the ſeventh redundant by a 7※ or ※7. But it may be ſaid, how ſhall we diſtinguiſh this chord from the ſeventh major, which, as it would ſeem, ought to be marked with a 7※? M. Rameau anſwers, that there is no danger of miſtake, becauſe in the ſeventh major, as the ſeventh ought to be prepared, it is found in the preceding chord; and thus the ſharp ſubſiſting already in the preceding chord, it would be uſeleſs to repeat it.

Thus *re ſol* (figured 7 ※), according to M. Rameau, would indicate *re fa※ la ut, ſol ſi re fa※*. If we would change *fa※* of the ſecond chord into *fa*, it would then be neceſſary to write *re ſol* (figured ※ 7♮). In notes ſuch as *ut*, whoſe natural ſeventh is major, the figure 7 preceded or followed by a ſharp will ſufficiently ſerve to diſtinguiſh the chord of the ſeventh redundant *ut ſol ſi re fa*, from the ſimple chord of the ſeventh *ut mi ſol ſi*, which is marked with a 7 alone. All this appears juſt and well founded.

(OOO) Suppoſition introduces into a chord diſſonances which were not in it before. For inſtance, if to the chord *mi ſol ſi re*, we ſhould add the note of ſuppoſition *ut* deſcending by a third, it is plain that, beſides the diſſonance

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art. 219. In this ſtate the chord is ſimply compoſed of a third, fifth, and ninth, and is marked with a 9. See LXXIX. (PPP)

218. What is more, in the chord of the ſimple dominant, as *re fa la ut*, when the fifth *ſol* is added, they frequently obliterate the ſounds *fa* and *la*, that too great a number of diſſonances may be avoided, which reduces the chord to *ſol ut re*. This laſt is compoſed only of the fourth and the fifth. It is called a *chord of the fourth*, and it is figured with a 4. (See LXXX.)

219. Sometimes they only remove the note *la*, and then the chord ought to be figured with $\frac{7}{4}$ or $\frac{+}{7}$ (QQQ).

263 Chord of the fifth redundant what, and how figured.

220. Finally, in the minor mode, for example, in that of *la*, where the chord of the tonic dominant (109,) is *mi ſol※ ſi re*; if we add to this chord the third *ut* below, we ſhall have *ut mi ſol※ ſi re*, called the *chord of the fifth redundant*, and compoſed of a third, a fifth redundant, a ſeventh, and a ninth. It is figured with a ※5, or a +5. See LXXXI. (RRR.)

§ 3. *Of the* Chord *of the* Diminished Seventh.

264 Chord of the flat ſenſible what, and how figured.

221. In the minor mode, for inſtance, in that of *la*, *mi* a fifth from *la* is the tonic dominant (109), and carries the chord *mi ſol※ ſi re*, in which *ſol* is the ſenſible note. For this chord they ſometimes ſubſtitute that other *ſol※ ſi re fa*, (116), all compoſed of minor thirds; and which has for its fundamental-ſound the ſenſible note *ſol※*. This chord is called a *chord of the flat, or diminiſhed ſeventh*, and is figured with a $\not 7$ in the fundamental baſs, (ſee LXXXII.): but it is always conſidered as repreſenting the chord of the tonic dominant.

265 Chords produced in the continued baſs by this what, and how figured.

222. This chord in the fundamental baſs produces in the continued baſs the following chords:

1. The chord *ſi re fa ſol※*, compoſed of a third, falſe fifth, and ſixth major. They call it the *chord of the ſixth ſenſible and falſe fifth*; and it is figured thus ※$^6_5$, or +$^6_5$. (See LXXXIII).

2. The chord *re fa ſol※ ſi*, compoſed of a third, a tritone, and a ſixth, they call it the *chord of the tritone and third minor*; and they mark it thus $\overset{4}{※}$♭. (See LXXXIV).

3. The chord *fa ſol※ ſi re*, compoſed of a ſecond redundant, a tritone, and a ſixth. They call it the *chord of the ſecond redundant*, and they figure it thus ※2, or +2. See LXXXV. (SSS).

266 Alterations by ſuppoſition, chords which they produce what, and how figured.

223. Beſides, ſince the chord *ſol※ ſi re fa* repreſents the chord *mi ſol※ ſi re*, it follows, that if we operate by ſuppoſition upon the firſt of theſe chords, it muſt be performed as one would perform it upon *mi*

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diſſonance between *mi* and *re* which was in the original chord, we have two new diſſonances, *ut ſi*, and *ut re*; that is to ſay, the ſeventh and the ninth. Theſe diſſonances, like the others, ought to be prepared and reſolved. They are prepared by being ſyncopated, and reſolved by deſcending diatonically upon one of the conſonances of the ſubſequent chord. The ſenſible note alone can be reſolved in aſcending; but it is even neceſſary that this ſenſible note ſhould be in the chord of the tonic dominant. As to the diſſonances which are found in the primitive chord, they ſhould always follow the common rules. (See art. 202.)

(PPP) Several muſicians call this laſt chord the *chord of the ninth*; and that which, with M. Rameau, we have ſimply called a *chord of the ninth*, they term a *chord of the ninth and ſeventh*. This laſt chord they mark with a $\frac{9}{7}$; but the denomination and figure uſed by M. Rameau are more ſimple, and can lead to no error; becauſe the chord of the ninth always includes the ſeventh, except in the caſes of which we have already ſpoken.

(QQQ) They often remove ſome diſſonances from chords of ſuppoſition, either to ſoften the harſhneſs of the chord, or to remove diſcords which can neither be prepared nor reſolved. For inſtance, let us ſuppoſe, that in the continued baſs the note *ut* is preceded by the ſenſible note *ſi*, carrying the chord of the falſe fifth, and that we ſhould chooſe to form upon this note *ut* the chord *ut mi ſol ſi re*, we muſt obliterate the ſeventh *ſi*, becauſe in retaining it we ſhould deſtroy the effect of the ſenſible note $\overset{8}{ſi}$, which ought to riſe to *ut*.

In the ſame manner, if to the harmony of a tonic dominant *ſol ſi re fa*, one ſhould add the note by ſuppoſition *ut*, it is uſual to retrench from this chord the ſenſible note *ſi*; becauſe, as the *re* ought to deſcend diatonically to *ut*, and the *ſi* to riſe to it, the effect of the one would deſtroy that of the other. This above all takes place in the *ſuſpence*, concerning which we ſhall preſently treat.

(RRR) *Suppoſition* produces what we call *ſuſpence*; and which is almoſt the ſame thing. Suſpenſion conſiſts in retaining as many as poſſible of the ſounds in a preceding chord, that they may be heard in the chord which ſucceeds. For inſtance, if this fundamental baſs be given *ut* $\overset{7}{ſol}$ *ut*, and this continued baſs above it *ut ut* $\overset{※7}{ut}$, it is a ſuppoſition; but if we have this fundamental baſs *ut* $\overset{7}{ſol}$ $\overset{7}{ſol}$ *ut*, and this continued baſs above it *ut ſol* $\overset{7}{ut}$ $\overset{※7}{ut}$, it is a ſuſpenſe; becauſe the perfect chord of *ut*, which we naturally expect after *ſol* in the continued baſs, is *ſuſpended* and *retarded* by the chord $\overset{※7}{ut}$, which is formed by retaining the ſounds *ſol ſi re fa* of the preceding chord to join them to the note *ut* in this manner, *ut ſol ſi re fa*; but this chord $\overset{※7}{ut}$ does nothing in this caſe but *ſuſpend* for a moment the perfect chord *ut mi ſol ut*, which ought to follow it.

(SSS) The chord of the diminiſhed ſeventh, ſuch as *ſol※ ſi re fa*, and the three derived from it, are termed *chords of ſubſtitution*. They are in general harſh, and proper for imitating melancholy objects.

Principles of Composition.

mi sol※ *si re*; that is to say, that it will be necessary to add to the chord *sol*※ *si re fa*, the notes *ut* or *la*, which are the third or fifth below *mi*, and which will produce,

1. By adding *ut*, the chord *ut sol*※ *si re fa*, composed of a fifth redundant, a seventh, a ninth, and eleventh, which is the octave of the fourth. It is called a *chord of the fifth redundant and fourth*, and thus marked $^{+5}_{4}$, or ※$^{5}_{4}$. (See LXXXVI.)

2. By adding *la*, we shall have the chord *la sol*※ *si re fa*, composed of a seventh redundant, a ninth, an eleventh, and a thirteenth minor, which is the octave of the sixth minor. It is called the *chord of the seventh redundant and sixth minor*, and marked $\flat\overset{7}{6}$, or $\overset{※7}{\flat}$. (See LXXXVII.) It is of all chords the most harsh, and the most rarely practised (TTT).

In the *Treatise of Harmony* by M. Rameau, and elsewhere, may be seen a much longer detail of the chords by supposition: But here we delineate the elements alone.

Chap. X. *Of some Licences used in the Treble and Continued Bass.*

267 Licence 1st. 224. Sometimes in a treble, the dissonance which ought to have been resolved by descending diatonically upon the succeeding note, instead of descending, on the contrary rises diatonically: but in that case, the note upon which it ought to have descended must be found in some of the other parts. This licence ought to be rarely practised.

In like manner, in a continued bass, the dissonance in a chord of the sub-dominant inverted, as *la* in the chord *la ut mi sol*, inverted from *ut mi sol la*, may sometimes descend diatonically instead of rising as it ought to do, art. 129. n° 2.; but in that case the note ought to be repeated in another part, that the dissonance may be there resolved in ascending.

268 Licence 2d. 225. Sometimes likewise, to render a continued bass more agreeable by causing it to proceed diatonically, they place between two sounds of that bass a note which belongs to the chord of neither. See example XCIV, in which the fundamental bass *sol ut* produces the continued bass *sol la si sol ut*, where *la* is added on account of the diatonic modulation. This *la* has a line drawn above it to show its resolution by passing under the chord *sol si re fa*.

In the same manner, (see XCV), this fundamental bass *ut fa* may produce the continued bass *ut re mi ut fa*, where the note *re* which is added passes under the chord *ut mi sol ut*.

Chap. XI. *Containing the Method of finding the Fundamental Bass when the Continued Bass is figured.*

226. To exercise yourself with greater ease in finding the fundamental bass, and to render it more familiar to you, it is necessary to observe how eminent masters, and above all how M. Rameau has put the rules in practice. Now, as they never place any thing but the continued bass in their works, it becomes then necessary to know how to find the fundamental bass when the continued bass is figured. This problem may be easily solved by the following rules. 269 How to find the fundamental bass when the continued is figured.

227. 1. Every note which has no figure in the continued bass, ought to be the same, and without a figure in the fundamental bass; it either is a tonic, or reckoned such, (UUU).

2. Every note which in the continued bass carries a 6, ought in the fundamental bass to give its third below not figured *, or its fifth below marked with a 7. We shall distinguish these two cases below. (See LVI. and LXIV, and the note ZZZ).

* See Fig. red.

3. Every note carrying $\frac{6}{4}$ gives in the fundamental bass its fifth below not figured. (See LVII.)

4. Every note figured with a 7 or a ♯, is the same in both basses, and with the same figure (XXX).

5. Every note figured with a 2 gives in the fundamental bass the diatonic note above figured with a 7. See LXII. (YYY).

6. Every note marked with a 4 gives in the fundamental

(TTT) As the chord of the diminished seventh *sol*※ *si re fa*, and the chord of the tonic dominant *mi sol*※ *si re*, only differ one from the other by the notes *mi* and *fa*; one may form a diatonic modulation of these two notes, and then the fundamental bass does nothing but pass from the tonic dominant to the sensible note, and from that note to the tonic dominant, till it arrives at the tonic. (See XCII.)

For the same reason, as the chord of the diminished seventh *sol*※ *si re fa*, and the chord *si re fa la*, which carries the fifth *si* of the tonic dominant *mi*, only differs by the sensible note *sol*※, and the tonic *la*; one may sometimes, while the treble modulates *sol*※ *la sol*※ *la sol*※ *la*, ascend in the fundamental bass, from the bass note to the third above, provided one descend at last from thence to the tonic dominant, and from thence to the tonic; (see XCIII.) As to what remains, this and the preceding examples are licences.

(UUU) I say a tonic, or *reckoned such*, because it may perhaps be a dominant from which the dissonance has been removed. But in that case one may know that it is a real dominant by the note which precedes it. For instance, if the note *sol*, carrying a perfect chord, is preceded by *re* a simple dominant, carrying the chord *re fa la ut*, that note *sol* is not a real tonic; because, in order to this, it would have been necessary that *re* should have been a tonic dominant, and should have carried the chord *re fa*※ *la ut*; and that a simple dominant, as *re*, carrying the chord *re fa la ut*, should only naturally descend to a dominant, (art. 194.)

(XXX) Sometimes a note which carries a 7 in the continued bass, gives in the fundamental bass its third above, figured with a 6. For example, this continued bass $\overset{7}{la}\ \overset{8}{si}\ ut$ gives this fundamental bass $\overset{6}{ut}\ \overset{7}{sol}\ ut$; but in this case it is necessary that the note figured with a 6 should rise by a fifth, as we see here *ut* rise to *sol*.

(YYY) A note figured with a 2, gives likewise sometimes in the fundamental bass its fourth above, figured with

mental bass the diatonic note above, figured with a 7. (See LXI.)

7. Every note figured with an 8 gives its third below figured with a 7. (See LVIII.)

8. Every note marked with a β gives the fifth below marked with a 7; (see LX.) and it is plain by art. 187, that in the chord of the seventh, of which we treat in these three last articles, the third ought to be major, and the seventh minor, this chord of the seventh being the chord of the tonic dominant. (See art. 102.)

9. Every note marked with a 9 gives its third above figured with a 7. (See LXXVII and LXXIX.)

10. Every note marked with a $^{9}_{4}$ gives the fifth above figured with a 7. (See LXXVIII.)

11. Every note marked with a ※5, or with a +5, gives the third above figured with a $\overset{7}{※}$. (See LXXXI.)

12. Every note marked with a ※7 gives a fifth above figured with a 7, or with a $\overset{7}{※}$. (See LXXVI.) It is the same case with the notes marked $^{7}_{4}$, $^{5}_{\overset{4}{2}}$ or $^{5}_{2}$: which shows a retrenchment, either in the complete chord of the eleventh, or in that of the seventh redundant.

13. Every note marked with a 4 gives a fifth above figured with a 7, or a $\overset{7}{※}$. (See LXXX.)

14. Every note marked with a ※$^{6}_{8}$ gives the third minor below, figured with a ♯. (See LXXXIII.)

15. Every note marked with a $\overset{4}{※♭}$ gives the tritone above figured with a ♯. (See LXXXIV.)

16. Every note marked with a +2 gives the second redundant above, figured with a ♯. (See LXXXV.)

17. Every note marked with a ※$^{5}_{4}$ gives the fifth redundant above, figured with a ♯. (See LXXXVI.)

18. Every note marked with a $\overset{※7}{♭6}$ gives the seventh redundant above, figured with a ♯. See LXXXVII. (zzz).

Remark.

228. We have omitted two cases, which may cause some uncertainty. 270 A difficulty in finding the fundamental bass.

The first is that where the note of the continued bass is figured with a 6. We now present the reason of the difficulty.

Suppose we should have the dominant $\overset{7}{re}$ in the fundamental bass, the note which answers to it in the continued bass may be *la* carrying the figure 6 (see LXIV.); that is to say, the chord *la ut re fa*: now if we should have the sub-dominant $\overset{6}{fa}$ in the fundamental

7 mental

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with a 6; but it is necessary in that case that the note figured with a 6, may even here rise to a fifth. (See note xxx).

These variations in the fundamental bass, as well in the chord concerning which we now treat, as in the chord figured with a 7, and in two others which shall afterwards be mentioned (art. 228 and 229), are caused by a deficiency in the signs proper for the chord of the sub-dominant, and for the different arrangements by which it is inverted.

M. l'Abbe Roussier, to redress this deficiency, had invented a new manner of figuring the continued bass. His method is most simple for those who know the fundamental bass. It consists in expressing each chord by only signifying the fundamental sound with that letter of the scale by which it is denominated, to which is joined a 7 or ♯, or a 6, in order to mark all the discords. Thus the fundamental chord of the seventh *re fa la ut* is expressed by a $\overset{7}{D}$; and the same chord, when it is inverted from that of the sub-dominant *fa la ut re*, is characterized by $\overset{6}{F}$; the chord of the second *ut re fa la*, inverted from the dominant *re fa la ut*, is likewise represented by $\overset{7}{D}$; and the same chord *ut re fa la* inverted from that of the sub-dominant *fa la ut re* is signified by F; the case is the same when the chords are differently inverted. By this means it would be impossible to mistake either with respect to the fundamental bass of a chord, or with respect to the note which forms its dissonance, or with respect to the nature and species of that discord.

(zzz) We may only add, that here and in the preceding articles, we suppose, that the continued bass is figured in the manner of M. Rameau. For it is proper to observe, that there are not, perhaps, two musicians who characterise their chords with the same figures; which produces a great inconveniency to the person who plays the accompaniments: but here we do not treat of accompaniments. For every reason, then, we should advise initiates to prefer the continued basses of M. Rameau to all the others, as by them they will most successfully study the fundamental bass.

It is even necessary to advertise the reader, and I have already done it (note eee), that M. Rameau only marks the lesser sixth by a 6 without a line, when this lesser sixth does not result from the chord of the tonic dominant; in such a manner that the 6 renders it uncertain whether in the fundamental bass we ought to choose the third or the fifth below: but it will be easy to see whether the third or the fifth is signified by that figure. This may be distinguished, 1. In observing which of the two notes is excluded by the rules of the fundamental bass. 2. If the two notes may with equal propriety be placed in the fundamental bass, the preference must be determined by the tone or mode of the treble in that particular passage. In the following chapter we shall give rules for determining the mode.

There is a chord of which we have not spoken in this enumeration, and which is called the *chord of the sixth redundant*. This chord is composed of a note, of its third major, of its redundant fourth or tritone, and its redundant sixth, as *fa la si re*※. It is marked with a 6※. It appears difficult to find a fundamental bass for this chord; nor is it indeed much in use amongst us. (See the note upon the art. 115.)

Principles of Compoſition.

mental baſs, this ſub-dominant might produce in the continued baſs the ſame note *la* figured with a 6. When therefore one finds in the continued baſs a note marked with a 6, it appears at firſt uncertain whether we ſhould place in the fundamental baſs the fifth below marked with a 7, or the third below marked with a 6.

271 Another. 229. The ſecond caſe is that in which the continued baſs is figured with a $\frac{6}{5}$. For inſtance, if there ſhould be found $\overset{6}{\underset{5}{}}$ *fa* in the continued baſs, one may be ignorant whether he ought to inſert in the fundamental baſs *fa* marked with a 6, or *re* figured with a 7.

272 Solution. 230. You may eaſily extricate yourſelf from this little difficulty, in leaving for an inſtant this uncertain note in ſuſpence, and in examining what is the ſucceeding note of the fundamental baſs; for if that note be in the preſent caſe a fifth above *fa*, that is to ſay, if it is *ut*, in this caſe, and in this alone, he may place $\overset{6}{fa}$ in the fundamental baſs. It is a conſequence of this rule, that in the fundamental baſs every ſub-dominant ought to riſe by a fifth (195).

Chap. XII. *What is meant by being in a Mode or Tone.*

273 Method of determining the mode in which we are. 231. In the firſt part of this treatiſe (chap. vi), we have explained, how by the means of the note *ut*, and of its two fifths *ſol* and *fa*, one in aſcending, which is called a *tonic dominant*, the other in deſcending, which is called a *ſub-dominant*, the ſcale *ut re mi fa ſol la ſi ut* may be found: the different ſounds which form this ſcale compoſe what we call the *major mode* of *ut*, becauſe the third *mi* above *ut* is major. If therefore we would have a modulation in the major mode of *ut*, no other ſounds muſt enter into it than thoſe which compoſe this ſcale; in ſuch a manner that if, for inſtance, I ſhould find *fa※* in this modulation, this *fa※* diſcovers to me that I am not in the mode of *ut*, or at leaſt that, if I have been in it, I am no longer ſo.

232. In the ſame manner, if I form this ſcale in aſcending *la ſi ut※ re mi fa※ ſol※ la*, which is exactly ſimilar to the ſcale *ut re mi fa ſol la ſi ut* of the major

mode of *ut*, this ſcale, in which the third from *la* to *ut※* is major, ſhall be in the major mode of *la*; and if I incline to be in the minor mode of *la*, I have nothing to do but to ſubſtitute for *ut* ſharp *ut* natural; ſo that the major third *la ut※* may become minor *la ut*; I ſhall have then

la ſi ut re mi fa※ ſol※ la,

which is (85) the ſcale of the minor mode of *la* in aſcending; and the ſcale of the minor mode of *la* in deſcending ſhall be (90)

la ſol fa mi ut re ſi la,

in which the *ſol* and *fa* are no longer ſharp. For it is a ſingularity peculiar to the minor mode, that its ſcale is not the ſame in riſing as in deſcending (89).

274 Hence it appears what ſharps and flats ſhould be placed at the cleff in the major mode of *la*, and why they are omitted in the minor mode in deſcending. 233. This is the reaſon why, when we wiſh to begin a piece in the major mode of *la*, we place three ſharps at the cleff upon *fa*, *ut*, and *ſol*; and on the contrary, in the minor mode of *la*, we place none, becauſe the minor mode of *la*, in deſcending, has neither ſharps nor flats.

275 Modes 24 in the whole. 234. As the ſcale contains twelve ſounds, each diſtant from the other by the interval of a ſemitone, it is obvious that each of theſe ſounds can produce both a major and a minor mode, which conſtitute 24 modes upon the whole. Of theſe we ſhall immediately give a table, which may be very uſeful to diſcover the mode in which we are.

A TABLE of the Different Modes.

Major Modes.

Maj Mode.	
of *ut*	*ut re mi fa ſol la ſi ut.*
of *ſol*	*ſol la ſi ut re mi fa※ ſol.*
of *re*	*re mi fa※ ſol la ſi ut※ re.*
of *la*	*la ſi ut※ re mi fa※ ſol※ la.*
of *mi*	*mi fa※ ſol※ la ſi ut※ re※ mi.*
of *ſi*	*ſi ut※ re※ mi fa※ ſol※ la※ ſi.*
of *fa※*	*fa※ ſol※ ſi ut※ re※ mi※ fa※* (AAAA).
of *ut※* or *re♭*	*re♭ mi♭ fa ſol♭ la♭ ſi♭ ut re♭.*
of *ſol※* or *la♭*	*la♭ ſi♭ ut re♭ mi♭ fa ſol la♭.*
of *re※* or *mi♭*	*mi♭ fa ſol la♭ ſi♭ ut re mi♭.*

of

(AAAA) The major mode of *fa※*, of *ut♭* or *re※*, and of *ſol※* or *la♭*, are not much practiſed. In the opera of *Pyramus* and *Thiſbe*, p. 267, there is a paſſage in the ſcene, of which one part is in the major mode of *fa※*, and the other in the major mode of *ut※*, and there are ſix ſharps at the cleff.

When a piece begins upon *ut※*, there ought to be ſeven ſharps placed at the cleff: but it is more convenient only to place five flats, and to ſuppoſe the key *re♭*, which is almoſt the ſame thing with *ut※*. It is for this reaſon that we ſubſtitute here the mode of *re♭* for that of *ut※*.

It is ſtill much more neceſſary to ſubſtitute the mode of *la♭* for that of *ſol※*; for the ſcale of the major mode of *ſol* is *ſol※, la※, ſi※, ut※, re※, mi※, ſol, ſol※*, in which you may ſee that there are at the ſame time both a *ſol* natural and a *ſol※*: it would then be neceſſary, even at the ſame time, that upon *ſol* there ſhould and ſhould not be a ſharp at the cleff; which is ſhocking and inconſiſtent. It is true that this inconvenience may be avoided by placing a ſharp upon *ſol* at the cleff, and by marking the note *ſol* with a natural through the courſe of the muſic wherever it ought to be natural; but this would become troubleſome, above all if there ſhould be occaſion to tranſpoſe. In the article 236, we ſhall give an account of tranſpoſition. One might likewiſe in this ſeries, inſtead of *ſol* natural, which is the note immediately before the laſt, ſubſtitute *fa※※*, that is to ſay, *fa* twice ſharp: which, however, is not abſolutely the ſame ſound with *ſol* natural, eſpecially upon inſtruments whoſe ſcales are fixed, or whoſe intervals are invariable. But in that caſe two ſharps may be placed at the cleff upon *fa*, which would produce another inconvenience. But by ſubſtituting *la♭* for *ſol※*, the trouble is eluded.

ciples ompo- tion.

of *la*※ or *ſi*♭ } *ſi*♭ *ut re mi*♭ *fa ſol la ſi.*
of *mi*※ or *fa*♭ } *fa ſol la ſi*♭ *ut re mi fa.*
of *ſi*※ or *ut*♭ } *ut re mi fa ſol la ſi ut.*

Minor Modes.

Of *la*.
In deſcending. *la ſol fa mi re ut ſi la.*
In riſing. *la ſi ut re mi fa*※ *ſol*※ *la.*

Of *mi*.
In deſcending. *mi re ut ſi la ſol fa*※ *mi.*
In riſing. *mi fa*※ *ſol la ſi ut*※ *re*※ *mi.*

Of *ſi*.
In deſcending. *ſi la ſol fa*※ *mi re ut*※ *ſi.*
In riſing. *ſi ut*※ *re mi fa*※ *ſol*※ *la*※ *ſi.*

Of *fa*※.
In deſcending. *fa*※ *mi re ut*※ *ſi la ſol*※ *fa.*
In riſing. *fa*※ *ſol*※ *la ſi ut*※ *re*※ *mi*※ *fa*※.

Of *ut*※
In deſcending. *ut ſi la ſol*※ *fa*※ *mi re*※ *ut*※.
In riſing. *ut*※ *re*※ *mi fa*※ *ſol*※ *la*※ *ſi*※ *ut*※.

Of *ſol*※ or *la*♭.
In deſcending. *ſol*※ *fa*※ *mi ut*※ *ſi la*※ *ſol*※.
In riſing. *la*♭ *ſi*♭ *ut*♭ *re*♭ *mi*♭ *fa ſol la*♭.

Of *re*※ or *mi*♭.
In deſcending. *mi*♭ *re*♭ *ut*♭ *ſi*♭ *la*♭ *ſol*♭ *fa mi*♭.
In riſing. *mi*♭ *fa ſol*♭ *la*♭ *ſi*♭ *ut re mi*♭.

Of *la*※ or *ſi*♭.
In deſcending. *ſi*♭ *la*♭, *ſol*♭ *fa mi*♭ *re*♭ *ut ſi*♭.
In riſing. *ſi*♭ *ut re*♭ *mi*♭ *fa ſol la ſi*♭.

Of *mi*※ or *fa*♭.
In deſcending. *fa mi*♭ *re*♭ *ut ſi*♭ *la*♭ *ſol fa.*
In riſing. *fa ſol la*♭ *ſi*♭ *ut re mi fa.*

Of *ut*.
In deſcending. *ut ſi*♭ *la*♭ *ſol fa mi*♭ *re ut.*
In riſing. *ut re mi*♭ *fa ſol la ſi ut.*

Of *ſol*.
In deſcending. *ſol fa mi*♭ *re ut ſi*♭ *la ſol.*
In riſing. *ſol la ſi*♭ *ut re mi fa*※ *ſol.*

Of *re*.
In deſcending. *re ut ſi*♭ *la ſol fa mi re.*
In riſing. *re mi fa ſol la ſi ut*※ *re* (BBBB.)

276 Modes crowded with ſharps and flats little practiſed.

235. Theſe then are all the modes, as well major as minor. Thoſe which are crowded with ſharps and flats are little practiſed, as being extremely difficult in execution.

277 Reſults.

236. From thence it follows,

1. That when there are neither ſharps nor flats at the cleff, it is a token that the piece begins in the major mode of *ut*, or in the minor mode of *la*.

2. That when there is one ſingle ſharp, it will always be placed upon *fa*, and that the piece begins in the major mode of *ſol*, or the minor of *mi*, in ſuch a manner that it may be ſung as if there were no ſharp, by ſinging *ſi* inſtead of *fa*※, and in ſinging the tune as if it had been in another cleff. For inſtance, let there be a ſharp upon *fa* in the cleff of *ſol* upon the firſt line; one may then ſing the tune as if there were no ſharp: And inſtead of the cleff of *ſol* upon the firſt line, let there be the cleff of *ut*; for the *fa*※, when changed into *ſi*, will require that the cleff of *ſol* ſhould be changed to the cleff of *ut*, as may be eaſily ſeen. This is what we call *tranſpoſition* (‡).

See *Tranſpoſition*.

278 All the modes reducible to the major of *ut* and the minor of *la*.

237. It is evident, that when *fa*※ is changed into *ſi*, *ſol* muſt be changed into *ut*, and *mi* into *la*. Thus by tranſpoſition, the air has the ſame melody as if it were in the major mode of *ut*, or in the minor mode of

(BBBB) We have already ſeen, that in each mode, the principal note is called a *tonic*; that the fifth above that note is called a *tonic dominant*, or the *dominant of the mode*, or ſimply a *dominant*; that the fifth beneath the tonic, or, what is the ſame thing, the fourth above that tonic, is called a *ſub-dominant*; and in ſhort, that the note which forms a ſemitone beneath the tonic, and which is a third major from the dominant, is called a *ſenſible note*. The other notes have likewiſe in every mode particular names which it is advantageous to know. Thus a note which is a tone immediately above the tonic, as *re* in the mode of *ut*, and *ſi* in that of *la*, is termed a *ſub-tonic*; the following note, which is a third major or minor from the tonic, according as the chord is major or minor, ſuch as *mi* in the major mode of *ut*, and *ut* in the minor mode of *la*, is called a *mediant*; in ſhort, the note which is a tone above the dominant, ſuch as *la* in the mode of *ut*, and *fa*※ in that of *la*, is called a *ſub-dominant*.

‡ Though our author's account of this delicate operation in muſic will be found extremely juſt and compendious; though it proceeds upon ſimple principles, and comprehends every poſſible contingency; yet as the manner of thinking upon which it depends may be leſs familiar to Engliſh readers, if not profoundly ſkilled in muſic, it has been thought proper to give a more familiar, though leſs comprehenſive, explanation of the manner in which *tranſpoſition* may be executed.

It will eaſily occur to every reader, that if each of the intervals through the whole diatonic ſeries were equal, in a mathematical ſenſe, it would be abſolutely indifferent upon what note any air were begun, if within the compaſs of the gammut; becauſe the ſame equal intervals muſt always have the ſame effects. But ſince, beſides the natural ſemitones, there is another diſtinction of diatonic intervals into *greater* and *leſſer tones*; and ſince theſe vary their poſitions in the ſeries of an octave, according as the note from whence you begin is placed, that note is conſequently the beſt key for any tune whoſe natural ſeries is moſt exactly correſpondent with the intervals which that melody or harmony requires. But in inſtruments whoſe ſcales are fixed, notwithſtanding the temperament and other expedients of the ſame kind, ſuch a ſeries is far from being eaſily found, and is indeed in common practice almoſt totally neglected. All that can frequently be done is, to take care that the ear may not be ſenſibly ſhocked. This, however, would be the caſe, if, in tranſpoſing any tune, the ſituation of the ſemitones, whether natural or artificial, were not exactly correſpondent in the ſeries to which your air muſt be tranſpoſed, with their poſitions in the ſcale from which you tranſpoſe it. Suppoſe for

of *la*. The major mode then of *ſol*, and the minor of *mi*, are by tranſpoſition reduced to thoſe of *ut* major, and of *la* minor. It is the ſame caſe with all the other modes, as any one may eaſily be convinced (cccc).

Chap. XIII. *To find the Fundamental Baſs of a given Modulation.*

238. As we have reduced to a very ſmall number the rules of the fundamental baſs, and thoſe which in the treble ought to be obſerved with relation to this baſs, it ſhould no longer be difficult to find the fundamental baſs of a given modulation, nay, frequently to find ſeveral; for every fundamental baſs will be legitimate, when it is formed according to the rules which we have given (Chap. VI.); and that, beſides this, the diſſonances which the modulation may form with this

279 Method of finding a fundamental baſs to a given air not difficult, and why.

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for inſtance, your air ſhould begin upon *ut* or C, requiring the natural diatonic ſeries through the whole gammut, in which the diſtance between *mi* and *fa*, or E and F, as alſo that between *ſi* and *ut*, or B and C, is only a ſemitone. Again, ſuppoſe it neceſſary for your voice, or the inſtrument on which you play, that the ſame air ſhould be tranſpoſed to *ſol* or G, a fifth above its former key; then becauſe in the firſt ſeries the intervals between the third and the fourth, ſeventh and eighth notes, are no more than ſemitones, the ſame intervals muſt take the ſame place in the octave to which you tranſpoſe. Now, from *ſol* or G, the note with which you propoſe to begin, the three tones immediately ſucceeding are full; but the fourth, *ut* or C, is only a ſemitone; it may therefore be kept in its place. But from *fa* or F, the ſeventh note above, to *ſol* or G, the eighth, the interval is a full tone, which muſt conſequently be redreſſed by raiſing your *fa* a ſemitone higher. Thus the ſituations of the ſemitonic intervals in both octaves will be correſpondent; and thus, by conforming the poſitions of the ſemitones in the octave to which you tranſpoſe, with thoſe in the octave in which the original key of the tune is contained, you will perform your operation with as much ſucceſs as the nature of fixed ſcales can admit: But the order in which you muſt proceed, and the intervals required in every mode, are minutely and ingeniouſly delineated by our author.

(cccc) Two ſharps, *fa*♯ and *ut*♯, indicate the major mode of *re*, or the minor of *ſi*; and then, by tranſpoſition, the *ut*♯ is changed into *ſi*, and of conſequence, *re* into *ut* and *ſi* into *la*.

Three ſharps, *fa*♯ *ut*♯ *ſol*♯ indicate the major mode of *la*, or the minor of *fa*♯; and it is then *ſol*♯, which muſt be changed into *ſi*, and of conſequence *la* into *ut*, and *fa*♯ into *la*.

Four ſharps, *fa*♯ *ut*♯ *ſol*♯ *re*♯, indicate the major mode of *mi*, or the minor of *ut*♯; then the *re*♯ is changed into *ſi*, and of conſequence *mi* into *ut*, and *ut*♯ into *la*.

Five ſharps, *fa*♯ *ut*♯ *ſol*♯ *re*♯ *la*♯, indicate the major mode of *ſi*, or the minor of *ſol*♯; *la* then is changed into *ſi*, and of conſequence *ſi* into *ut*, and *ſol*♯ into *la*.

Six ſharps, *fa*♯ *ut*♯ *ſol*♯ *re*♯ *la*♯ *mi*♯, indicate the major mode of *fa*♯; *mi*♯ then is changed into *ſi*, and of conſequence *fa*♯ into *ut*.

Six flats, *ſi*♭ *mi*♭ *la*♭ *re*♭ *ſol*♭ *ut*♭, indicate the minor mode of *mi*♭; *ut* is changed into *fa*, and of conſequence *mi*♭ into *la*.

Five flats, *ſi*♭ *mi*♭ *la*♭ *re*♭ *ſol*♭, indicate the major mode of *re*♭, or the minor mode of *ſi*♭; then the *ſi*♭ is changed into *fa*, and of conſequence the *re*♭ into *ut*, and the *ſi*♭ into *la*.

Four flats, *ſi*♭ *mi*♭ *la*♭ *re*♭, indicate the major mode of *la*♭, or the minor mode of *fa*; *re*♭ then is changed into *fa*, and of conſequence *la*♭ into *ut*, and *fa* into *la*.

Three flats, *ſi*♭ *mi*♭ *la*♭, indicate the major mode of *mi*♭, or the minor of *ut*; the *la*♭ then is changed into *fa*, and of conſequence *mi*♭ into *ut*, and the *ſol* into *la*.

Two flats, *ſi*♭ *mi*♭, indicate the major mode of *ſi*♭, or the minor of *ſol*; *mi*♭ then is changed into *fa*, and of conſequence *ſi*♭ into *ut*, and the *fa* into *la*.

One flat, *ſi*♭, indicates the major mode of *fa*, or the minor mode of *re*, and *ſi*♭ is changed into *fa*; of conſequence the *fa* is changed into *ut*, and the *re* into *la*.

All the major modes then may be reduced to that of *ut*, and the modes minor to that of *la* minor.

It only remains to remark, that many muſicians, and amongſt others the ancient muſicians of France, as Lulli, Campra, &c. place one flat leſs in the minor mode: ſo that in the minor mode of *re*, they place neither ſharp nor flat at the cleff; in the minor mode of *ſol*, one flat only; in the minor mode of *ut*, two flats, &c.

This practice in itſelf is ſufficiently indifferent, and ſcarcely merits the trouble of a diſpute. Yet the method which we have here deſcribed, according to M. Rameau, has the advantage of reducing all the modes to two; and beſides it is founded upon this ſimple and very general rule, That in the major mode, we muſt place as many ſharps or flats at the cleff, as are contained in the diatonic ſcale of that mode in aſcending; and in the minor mode, as many as are contained in that ſame ſcale in deſcending.

However this be, I here preſent you with a rule for tranſpoſition, which appears to me more ſimple than the rule in common uſe.

For the Sharps.

Suppoſe *ſol*, *re*, *la*, *mi*, *ſi*, *fa*, and change *ſol* into *ut* if there is one ſharp at the cleff, *re* into *ut* if there are two ſharps, *la* into *ut* if there are three, &c.

For the Flats.

Suppoſe *fa*, *ſi*, *mi*, *la*, *re*, *ſol*, and change *fa* into *ut* if there is only one flat at the cleff, *ſi* into *ut* if there are two flats, *mi* into *ut* if there are three, &c.

Principles of Compoſition.

this baſs, will both be prepared, if it is neceſſary that they ſhould be ſo, and always reſolved (DDDD).

280 Difficulty of aſſigning general rules for aſcertaining the mode of a melody whoſe fundamental baſs is ſought.

239. It is of the greateſt utility in ſearching for the fundamental baſs, to know what is the tone or mode of the melody to which that baſs ſhould correſpond. —But it is difficult in this matter to aſſign general rules, and ſuch as are abſolutely without exception, in which nothing may be left that appears indifferent or diſcretionary; becauſe ſometimes we ſeem to have the free choice of referring a particular melody either to one mode or another. For example, this melody *ſol ut* may belong to all the modes, as well major as minor, in which *ſol* and *ut* are found together; and each of theſe two ſounds may even be conſidered as belonging to a different mode.

281 Reaſons why one may proceed without the knowledge of the mode, and how he may be preſerved from deviating in compoſition.

240. For what remains, one may ſometimes, as it ſhould ſeem, operate without the knowledge of the mode, for two reaſons: 1. Becauſe, ſince the ſame ſounds belong to ſeveral different modes, the mode is ſometimes conſiderably undetermined; above all, in the middle of a piece, and during the time of one or two bars. 2. Without giving ourſelves much trouble about the mode, it is often ſufficient to preſerve us from deviating in compoſition, if we obſerve in the ſimpleſt manner the rules above preſcribed (ch. VI.) for the procedure of the fundamental baſs.

282 Knowledge of the mode in beginning a piece indiſpenſable, and why.

241. In the mean time, it is above all things neceſſary to know in what mode we operate at the beginning of the piece, becauſe it is indiſpenſable that the fundamental baſs ſhould begin in the ſame mode, and that the treble and baſs ſhould likewiſe end in it; nay, that they ſhould even terminate in its fundamental note, which in the mode of *ut* is *ut*, and *la* in that of *la*, &c. Beſides, in thoſe paſſages of the modulation where there is a cadence, it is generally neceſſary that the mode of the fundamental baſs ſhould be the ſame with that of the part to which it correſponds.

283 Inveſtigation of the mode continued.

242. To know upon what mode or in what key a piece commences, our inquiry may be entirely reduced to diſtinguiſh the major mode of *ut* from the minor of *la*. For we have already ſeen (art. 236. and 237.), that all the modes may be reduced to theſe two, at leaſt in the beginning of the piece. We ſhall now therefore give a detail of the different means by which theſe two modes may be diſtinguiſhed.

284 Means by which the modes may be determined.

1. From the principal and characteriſtical ſounds of the mode, which are *ut mi ſol* in the one, and *la ut mi* in the other; ſo that if a piece ſhould, for inſtance, begin thus, *la ut mi la*, it may be almoſt conſtantly concluded, that the tone or mode is in *la* minor, although the notes *la ut mi* belong to the mode of *ut*.

2. From the ſenſible note, which is *ſi* in the one, and *ſol*♯ in the other; ſo that if *ſol*♯ appears in the firſt bars of a piece, one may be certain that he is in the mode of *la*.

3. From the adjuncts of the mode, that is to ſay, the modes of its two fifths, which for *ut* are *fa* and *ſol*, and *re* and *mi* for *la*. For example, if after having begun

3 Z 2

(DDDD) We often ſay, *that we are upon a particular key*, inſtead of ſaying *that we are in a particular mode.* The following expreſſions therefore are ſynonymous; *ſuch a piece is in* ut *major*, or *in the mode of* ut *major*, or *in the key of* ut *major*.

We have ſeen that the diatonic ſcale or gammut of the Greeks was *la ſi ut re mi fa ſol la* (art. 49.) A method has likewiſe been invented of repreſenting each of the ſounds in this ſcale by a letter of the alphabet; *la* by A, *ſi* by B, *ut* by C, &c. It is from hence that theſe forms of ſpeaking proceed: Such a piece is upon A, *with* mi, la, *and its third minor*; or, ſimply, it is upon A, *with* mi, la, *and its minor*; ſuch another piece upon C, *with* ſol, ut, *and its third major*; or, ſimply, upon C, *with* ſol, ut, *and its major*; to ſignify that the one is the mode of *la minor*, or that the other is in that of *ut major*; this laſt manner of ſpeaking is more conciſe, and on this account it begins to become general.

They likewiſe call the cleff of *ut fa*F, the cleff of *re ſol*G, &c. to denominate the cleff of *fa*, the cleff of *ſol*, &c.

They ſay likewiſe to take the A *mi la*, to give the A *mi la*; that is to ſay, to take the uniſon of a certain note called *la* in the harpſichord, which *la* is the ſame that occupies the fifth line, or the higheſt line in the firſt cleff of *fa*. This *la* divides in the middle the two octaves which ſubſiſt (note RR) between the *ſol* which occupies the firſt line in the cleff of *ſol* upon that ſame line, and that *ſol* which occupies the firſt line in the cleff of *fa* upon the fourth; and as it poſſeſſes (if we may ſpeak ſo) the middle ſtation between the ſharpeſt and loweſt ſounds, it has been choſen to be the ſound with relation to which all the voices and inſtruments ought to be tuned in a concert (§).

(§) Thus far our author: and though the note is no more than an illuſtration of the technical phraſeology in his native language, we did not think it conſiſtent with the fidelity of a tranſlation to omit it. We have little reaſon to envy, and ſtill leſs to follow, the French in their abbreviations of ſpeech; the native energy of our tongue ſuperſedes this neceſſity in a manner ſo effectual, that, in proportion as we endeavour to become ſuccinct, our ſtyle, without the ſmalleſt ſacrifice of perſpicuity, becomes more agreeable to the genius of our language; whereas, in French, laconic diction is equally ambiguous and diſagreeable. Of this we cannot give a more flagrant inſtance than the note upon which theſe obſervations are made, in its original. We muſt, however, follow the author's example, in reciting a few technical phraſes upon the ſame ſubject, which occur in our language, and which, if we are not miſtaken, will be found equally conciſe, at the ſame time that they are more natural and intelligible. When we mean to expreſs the fundamental note of that ſeries within the diatonic octave which any piece of muſic demands, we call that note the *key*. When we intend to ſignify its mode, whether major or minor, we denominate the harmony *ſharp* or *flat*. When in a concert we mean to try how inſtruments are in tune by that note upon which, according to the genius of each particular inſtrument, they may beſt agree in uniſon, we deſire the muſicians who join us to ſound A.

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gun a melody by some of the notes which are common to the modes of *ut* and of *la* (as *mi re mi fa mi re ut si ut)*, I should afterwards find the mode of *sol*, which I ascertain by the *fa*♯, or that of *fa* which I ascertain by the *si*♭ or *ut*♮, I may conclude that I have begun in the mode of *ut*; but if I find the mode of *re*, or that of *mi*, which I ascertain by *si*♭, *ut*♯, or *re*♯, &c. I conclude from thence that I have begun in the mode of *la*.

4. A mode is not for ordinary deserted, especially in the beginning of a piece, but that we may pass into one or other of these modes which are most relative to it, which are the mode of its fifth above, and that of its third below, if the original mode be major, or of its third above if it be minor. Thus, for instance, the modes which are most intimately relative to the major mode of *ut*, are the major mode of *sol*, and that of *la* minor. From the mode of *ut* we commonly pass either into the one or the other of these modes; so that we may sometimes judge of the principal mode in which we are, by the relative mode which follows it, or which goes before it, when these relative modes are decisively marked. For what remains, besides these two relative modes, there are likewise two others into which the principal mode may pass, but less frequently, viz. the mode of its fifth below, and that of its third above, as *fa* and *mi* for the mode of *ut* (EEEE).

5. The modes may still be likewise distinguished by the cadences of the melody. These cadences ought to occur at the end of every two, or at most of every four bars, as in the fundamental bass: now the note of the fundamental bass which is most suitable to these closes*, is always easy to be found. For the sounds which occur in the treble may be consulted M. Rameau, p. 54. of his *Nouveau Systeme de Musique theorique et pratique* (FFFF).

* See *Cadence*.

285 Having ascertained the mode, the fundamental bass not difficult.

When a person is once able to ascertain the mode, and can render himself sure of it by the different means which we have pointed out, the fundamental bass will cost little pains. For in each mode there are three fundamental sounds.

1. The tonic of the mode, or its principal sound, which carries always the perfect chord major or minor, according as the mode itself is major or minor.

Major mode of UT. *ut mi sol ut.*

Minor mode of LA. *la ut mi la.*

2. The tonic dominant, which is a fifth above the tonic, and which, whether in the major or minor mode, always carries a chord of the seventh, composed of a third major followed by two thirds minor.

Tonic dominant.

Major mode of UT. *sol si re fa.*

Tonic dominant.

Minor mode of LA. *mi sol*♯ *si re.*

3. The sub-dominant, which is a fifth below the tonic, and which carries a chord composed of a third, fifth, and sixth major, the third being either greater or lesser, according as the mode is major or minor.

Sub-dominant.

Major mode of UT. *fa la ut re.*

Minor mode of LA. *re fa la si.*

These three sounds, the tonic, the tonic dominant, and the sub-dominant, contain in their chords all the notes which enter into the scale of the mode; so that when a melody is given, it may almost always be found which of these three sounds should be placed in the fundamental bass, under any particular note of the upper part. Yet it sometimes happens that not one of these notes can be used. For example, let it be supposed that we are in the mode of *ut*, and that we find in the melody these two notes *la si* in succession; if we confine ourselves to place in the fundamental bass one of the three sounds *ut sol fa*, we shall find nothing for the sounds *la* and *si* but this fundamental bass $\overset{6}{fa}$ $\overset{7}{sol}$; now such a succession as $\overset{6}{fa}$ to $\overset{7}{sol}$ is prohibited by the fifth rule for the fundamental bass, according to which every sub-dominant, as *fa*, should rise by a fifth; so that $\overset{6}{fa}$ can only be followed by *ut* in the fundamental bass, and not by $\overset{7}{sol}$.

To remedy this, the chord of the sub-dominant *fa la ut re* must be inverted into a fundamental chord of the seventh, in this manner, *re fa la ut*, which has been called the *double employment* (art. 105.) because it is a secondary manner of employing the chord of the sub-

(EEEE) It is certain that the minor mode of *mi* has an extremely natural connection with the mode of *ut*, as has been proven (art. 92.) both by arguments and by examples. It has likewise appeared in the note upon the art. 93. that the minor mode of *re* may be joined to the major mode of *ut*: and thus in a particular sense, this mode may be considered as relative to the mode of *ut*, but it is still less so than the major modes of *sol* and *fa*, or than those of *la* and *mi* minor; because we cannot immediately, and without licence, pass in a fundamental bass from the perfect minor chord of *ut* to the perfect minor chord of *re*; and if you pass immediately from the major mode of *ut* to the minor mode of *re* in a fundamental bass, it is by passing, for instance, from the tonic *ut*, or from *mi sol ut*, to the tonic dominant of *re*, carrying the chord *la ut*♯ *mi sol*, in which there are two sounds, *mi sol*, which are found in the preceding chord; or otherwise from *ut mi sol ut* to *sol si*♭ *re mi*, a chord of the sub-dominant in the minor mode of *re*, which chord has likewise two sounds, *sol* and *mi*, in common with that which went immediately before it.

(FFFF) All these different manners of distinguishing the modes ought, if we may speak so, to give mutual light and assistance one to the other. But it often happens, that one of these signs alone is not sufficient to determine the mode, and may even lead to error. For example, if a piece of music begins with these three notes, *mi ut sol*, we must not with too much precipitation conclude from thence that we are in the major mode of *ut*, although these three sounds, *mi ut sol*, be the principal and characteristical sounds in the major mode of *ut*: we may be in the minor mode of *mi*, especially if the note *mi* should be long. You may see an example in the fourth act of *Zoroaster*, where the first air sung by the priests of Arimanes begins thus with two times *sol mi*♭ *si*♭, each of these notes being a crotchet. The air is in the minor mode of *sol*, and not in the major mode of *mi*♭, as one would at first be tempted to believe it. Now we may be sensible that it is in *sol* minor, by the relative modes which follow, and by the notes where the cadences fall.

sub-dominant. By these means we give to the modulation *la si*, this fundamental bass $\overset{7}{re}$ $\overset{7}{sol}$, which procedure is agreeable to rules.

Here then are four chords, *ut mi sol ut*, *sol si re fa*, *fa la ut re*, *re fa la ut*, which may be employed in the major mode of *ut*. We shall find in like manner, for the minor mode of *la*, four chords,

la ut mi la, *mi sol♯ si re*,
re fa la si, *si re fa la*.

And in this mode we sometimes change the last of these chords into *si re fa♯ la*, substituting the *fa♯* for *fa♮*. For instance, if we have this melody in the minor mode of *la mi fa♯ sol♯ la*, we would cause the first note *mi* to carry the perfect chord *la ut mi la*, the second note *fa♯* to carry the chord of the seventh *si re fa♯ la*, the third note *sol♯* the chord of the tonic dominant *mi sol♯ si re*, and in short, the last the perfect chord *la ut mi la*.

On the contrary, if this melody is given always in the minor mode *la la sol♯ la*, the second *la* being syncopated, it might have the same bass as the modulation *mi fa♯ sol♯ la*, with this difference alone, that *fa♮* might be substituted for *fa♯* in the chord *si re fa♯ la*, the better to mark out the minor mode.

Besides these chords which we have just mentioned, and which may be regarded as the principal chords of the mode, there are still a great many others; for example, the series of dominants,

$$\overset{}{ut}\ \overset{7}{la}\ \overset{7}{re}\ \overset{7}{sol}\ \overset{7}{ut}\ \overset{7}{fa}\ \ \overset{7}{si}\ \overset{7}{mi}\ \overset{7}{la}\ \overset{7}{re}\ \overset{7}{sol}\ ut,$$

which are terminated equally in the tonic *ut*, either entirely belong, or at least may be reckoned as belonging (GGGG) to the mode of *ut*; because none of these dominants are tonic dominants, except *sol*, which is the tonic dominant of the mode of *ut*; and besides, because the chord of each of these dominants forms no other sounds than such as belong to the scale of *ut*.

But if I were to form this fundamental bass,

$$ut\ \overset{7}{la}\ \overset{7}{re}\ \overset{7}{sol}\ \overset{7\flat}{ut},$$

considering the last *ut* as a tonic dominant in this manner, *ut mi sol si♭*; the mode would then be changed at the second *ut*, and we should enter into the mode of *fa*, because the chord *ut mi sol si♭* indicates the tonic dominant of the mode of *fa*; besides, it is evident that the mode is changed, because *si♭* does not belong to the scale of *ut*.

In the same manner, were I to form this fundamental bass

$$ut\ \overset{7}{la}\ \overset{7}{re}\ \overset{7}{sol}\ \overset{6}{ut},$$

considering the last *ut* as a tonic dominant, in this manner, *ut mi sol la*; this last *ut* would indicate the mode of *sol*, of which *ut* is the *sub-dominant*.

In like manner, still, if in the first series of dominants, I caused the first *re* to carry the third major, in this manner, *re fa♯ la ut*; this *re* having become a tonic dominant, would signify to me the major mode of *sol*, and the $\overset{7}{sol}$ which should follow it, carrying the chord *si re fa*, would relapse into the mode of *ut*, from whence we had departed.

Finally, in the same manner, if in this series of dominants, one should cause *si* to carry *fa♯* in this manner, *si re fa♯ la*, this *fa* would show that we had departed from the mode *ut*, to enter into that of *sol*.

From hence it is easy to form this rule for discovering the changes of mode in the fundamental bass.

1. When we find a tonic in the fundamental bass, we are in the mode of that tonic; and the mode is major or minor, according as the perfect chord is major or minor. 286 A rule for discovering the changes of mode.

2. When we find a sub-dominant, we are in the mode of the fifth above that sub-dominant; and the mode is major or minor, according as the third in the chord of the sub-dominant is major or minor.

3. When we find a tonic dominant, we are in the mode of the fifth below that tonic dominant. As the tonic dominant carries always the third major, one cannot be secure by the assistance of this dominant alone, whether the mode be major or minor: but it is only necessary for the composer to cast his eye upon the following note, which must be the tonic of the mode in which he is; by the third of this tonic he will discover whether the mode be major or minor.

243. Every change of the mode supposes a cadence; and when the mode changes in the fundamental bass, it is almost always either after the tonic of the mode in which we have been, or after the tonic dominant of that mode, considered then as a tonic by favour of a close which ought necessarily to be found in that place: Whence it happens that cadences in a melody for the most part presage a change of mode which ought to follow them.

244. All these rules, joined with the table of modes which we have given (art. 234.), will serve to discover in what mode we are in the middle of a piece, especially in the most essential passages, as cadences (HHHH).

I here subjoin the soliloquy of Armida, with the continued and fundamental basses. The changes of the mode will be easily distinguished in the fundamental bass,

(GGGG) I have said, *that they may be reckoned as belonging to this mode*, for two reasons: 1. Because, properly speaking, there are only three chords which essentially and primitively belong to the mode of *ut*, viz. *ut* carrying the perfect chord, *fa* carrying that of the sub-dominant, and *sol* that of the tonic dominant, to which we may join the chord of the seventh, *re fa la ut* (art 105.): but we here regard *as extended* the series of dominants in question, as belonging to the mode of *ut*, because it preserves in the ear the impression of that mode. 2. In a series of dominants, there are a great many of them which likewise belong to other modes; for instance, the simple dominant *la* belongs naturally to the mode of *sol*, the simple dominant *si* to that of *la*, &c. Thus it is only improperly, and by way of extension, as I have already said, that we regard here these dominants as belonging to the mode of *ut*.

(HHHH) Two modes are so much more intimately relative as they contain a greater number of sounds common to both; for example, the minor mode of *ut* and the major of *sol*, or the major mode of *ut* and the minor of

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bass, by the rules which we have just given at the end of the article 242. This soliloquy will serve for a lesson to beginners. M. Rameau quotes it in his New System of Music, as an example of modulation highly just and extremely simple. (See Plate VI. and the following (IIII).

Chap. XIV. *Of the Chromatic and Enharmonic.*

287 Chromatic, what.

245. We call that melody *chromatic* which is composed of several notes in succession, whether rising or descending by semitones. (See LXXXVIII. and LXXXIX.)

288 To an air descending by chromatic intervals, fundamental bass, what.

246. When an air is chromatic in descending, the most natural and ordinary fundamental bass is a concatenated series of tonic dominants; all of which follow one another in descending by a fifth, or which is the same thing, in rising by a fourth. See LXXXVIII (LLLL).

289 Ascending, what.

247. When the air is chromatic in ascending, one may form a fundamental bass by a series of tonics and of tonic dominants, which succeed one another alternately by the interval of a third in descending, and of a fourth in ascending, (see LXXXIX). There are many other ways of forming a chromatic air, whether in rising or descending; but these details in an elementary essay are by no means necessary.

290 Enharmonic little practised.

248. With respect to the enharmonic, it is very rarely put in practice; and we have explained its formation in the first book, to which we refer our readers. We shall content ourselves with saying, that, in the beautiful soliloquy of the fourth act of Dardanus, at the words *lieux funestes*, &c. "fatal places, &c." we find an example of the enharmonic; an example of the diatonic enharmonic in the trio of the Fatal Sisters, in Hippolitus and Aricia, at the words, *Ou cours-tu malheureux*, "Whither, unhappy, dost thou run;" and that there are no examples of the chromatic enharmonic, at least in our French operas. M. Rameau had imitated an earthquake by this species of music, in the second act of the Gallant Indians; but he informs us, that in 1735 he could not cause it to be executed by the band. The trio of the Fatal Sisters in Hippolitus has never been sung in the opera as it is composed. But M. Rameau asserts, (and we have heard it elsewhere by people of taste, before whom the piece was performed), that the trial had succeeded when made by able hands that were not mercenary, and that its effect was astonishing.

Chap. XV. *Of Design, Imitation, and Fugue.*

See *Design*.

291 Design, what.

249. In music, the name of *design*, or *subject*, is generally given to a particular air or melody, which the composer intends should prevail through the piece; whether it is intended to express the meaning of words to which it may be set, or merely inspired by the impulse of taste and fancy. In this last case, design is distinguished into *imitation* and *fugue*.

See *Imitation*.

292 Imitation, what.

250. *Imitation* consists in causing to be repeated the melody of one or of several bars in one single part, or in the whole harmony, and in any of the various modes that

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of *la*: on the contrary, two modes are less intimately relative as the number of sounds which they contain as common to both is smaller; for instance, the major mode of *ut* and the minor of *si*, &c.

When you find yourself led away by the current of the modulation, that is to say, by the manner in which the fundamental bass is constituted, into a mode remote from that in which the piece was begun, you must continue in it but for a short time, because the ear is always impatient to return to the former mode.

(IIII) It is extremely proper to remark, that we have given the fundamental, the continued bass, and in general the modulation of this soliloquy, merely as a lesson in composition extremely suitable to *beginners*; not that we recommend the soliloquy in itself as a model of expression. Upon this last object what we have said may be seen in what we have written concerning the liberties to be taken in music, Vol. IV. p. 435, of our Literary Miscellany. It is precisely because this soliloquy is a proper lesson for initiates, that it would be a bad one for the mature and ingenious artist. The novice should learn tenaciously to observe his rules; the man of art and genius ought to know on what occasions and in what manner they may be violated when this expedient becomes necessary.

(LLLL) We may likewise give to a chromatic melody in descending, a fundamental bass, into which may enter chords of the seventh and of the diminished seventh, which may succeed one another by the intervals of a false fifth and a fifth redundant: thus in the Example XC. where the continued bass descends chromatically, it may easily be seen that the fundamental bass carries successively the chords of the seventh and of the seventh diminished, and that in this bass there is a false fifth from *re* to *sol*✻, and a fifth redundant from *sol*✻ to *ut*.

The reason of this licence is, as it appears to me, because the chord of the diminished seventh may be considered as representing (art. 221.) the chord of the tonic dominant; in such a manner that this fundamental bass

7 ~~7~~ 7 7 7 ✻[7]
la re sol✻ *ut fa*✻ *si mi la*

(see Example XCI.) may be considered as representing (art. 116.) that which is written below,

7 ✻[7] 7 7 7 ✻[7]
la re mi ut fa✻ *si mi la*

Now this last fundamental bass is formed according to the common rules, unless that there is a broken cadence from *re* to ✻[7] *mi*, and an interrupted cadence from *mi* to *ut*, which are licenses (art. 213 and 214.)

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that may be chosen. When all the parts absolutely repeat the same air† or melody, and beginning one after the other, this is called a *canon*. *Fugue* consists in alternately repeating that air in the treble, and in the bass, or even in all the parts, if there are more than two.

* See *Air*, *Canon*, *Fugue*.

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Principal rules for composing in several parts.

251. Imitation and fugue are sometimes conducted by rules merely deducible from taste, which may be seen in the 332d and following pages of M. Rameau's *Treatise on Harmony*; where will likewise be found a detail of the rules for composition in several parts. The chief rules for composition in several parts are, that the discords should be found, as much as possible, prepared and resolved in the same part; that a discord should not be heard at the same time in several parts, because its harshness would disgust the ear; and that in no particular part there should be found two octaves or two fifths in succession (MMMM) with respect to the bass. Musicians, however, do not hesitate sometimes to violate this precept, when taste or occasion require. In music, as in all the other fine arts, it is the business of the artist to assign and to observe rules; the province of men who are adorned with taste and genius is to find the exceptions.

Chap. XVI. *Definitions of the Different Airs.*

252. We shall finish this treatise by giving in a few words the characteristic distinctions of the different airs to which names have been given, as *chacoon*, *minuet*, *rigadoon*, &c.

The *chacoon* is a long piece of music, containing three times in each bar, of which the movement is regular, and the bars sensibly distinguished. It consists of several couplets, which are varied as much as possible. Formerly the bass of the chacoon was a *constrained bass*, or regulated by a rhythmus terminating in 4 bars, and proceeding again by the same number; at present composers of this species no longer confine themselves to that practice. The chacoon begins, for the most part, not with the perfect time, which is struck by the hand or foot, but with the imperfect, which passes while the hand or foot is elevated.

The *villanelle* is a chacoon a little more lively, with its movement somewhat more brisk than the ordinary chacoon.

The *passacaille* only differs from a chacoon as it is more slow, more tender, and beginning for ordinary with a perfect time.

The *minuet* is an air in triple time, whose movement is regular, and neither extremely brisk nor slow, consisting of two parts or strains, which are each of them repeated; and for which reason they are called by the French *reprises*: each strain of the minuet begins with a time which is struck, and ought to consist of 4, of 8, or of 12 bars; so that the cadences may be easily distinguished, and recur at the end of each 4 bars.

The *sarabando* is properly a slow minuet; and the *courant* a very slow sarabando: this last is no longer in use. The *passepied* is properly a very brisk minuet, which does not begin like the common minuet, with a stroke of the foot or hand; but in which each strain begins in the last of the three times of which the bar consists.

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The *loure* is an air whose movement is slow, whose time is marked with $\frac{6}{4}$, and where two of the times in which the bar consists are beaten; it generally begins with that in which the foot is raised. For ordinary the note in the middle of each time is shortened, and the first note of the same time pointed.

The *jig* is properly nothing else but a loure very brisk, and whose movement is extremely quick.

The *forlana* is a moderate movement, and in a mediocrity between the loure and the jig.

The *rigadoon* has two times in a bar, is composed of two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars: its movement is lively; each strain begins, not with a stroke of the foot, but at the last note of the second time.

The *bourée* is almost the same thing with the rigadoon.

The *gavotte* has two times in each bar, is composed of two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars: the movement is sometimes slow, sometimes brisk; but never extremely quick, nor very slow.

The *tambourin* has two strains, each to be repeated, and each consisting of 4, of 8, or of 12 bars, &c. Two of the times that make up each bar are beaten, and are very lively; and each strain generally begins in the second time.

The *musette* consists of two or three times in each bar; its movement is neither very quick nor very slow; and for its bass it has often no more than a single note, which may be continued through the whole piece.

APPENDIX.

The treatise of D'Alembert, of which we have given a translation, is well entitled to the merit of accuracy; but perhaps a person who has not particularly studied the subject, may find difficulty in following the scientific deductions of that author.—We subjoin, therefore, a few general observations on the philosophy of musical sound, commonly called *harmonics*, which may perhaps convey the full portion of knowledge of the theory of music, with which one in search only of general information, and not a professed student of this particular science, would choose to rest satisfied.

The theory of musical sound, which only in the beginning of the present century was ultimately established by mathematical demonstration, is no other than that which distinguished the ancient musical sect who

(MMMM) Yet there may be two fifths in succession, provided the parts move in contrary directions, or, in other words, if the progress of one part be ascending, and the other descending; but in this case they are not properly two fifths, they are a fifth and a twelfth; for example, if one of the parts in descending should sound *sa re*, and the other *ut la* in rising, *ut* is the fifth of *sa*, and *la* the twelfth of *re*.

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who followed the opinions of Pythagoras on that fubject.

No part of natural philofophy has been more fruitful of hypothefis than that of which mufical found is the object. The mufical fpeculators of Greece arranged themfelves into a great number of different fects, the chief of whom were the Pythagoreans and the Ariftoxenians.

Pythagoras fuppofed the air to be the *vehicle* of found; and the agitation of that element, occafioned by a fimilar agitation in the parts of the founding body, to be the *caufe* of it. The vibrations of a ftring or other fonorous body, being communicated to the air, affected the auditory nerves with the fenfation of found; and this found, he argued, was acute or grave in proportion as the vibrations were quick or flow.—He difcovered by experiment, that of two ftrings equal in every thing but length, the fhorter made the quicker vibrations, and emitted the acuter found:—in other words, that the number of vibrations made in the fame time, by two ftrings of different lengths, was inverfely as thofe lengths; that is, the greater the length the fmaller the number of vibrations in any given time. Thus found, confidered in the vibrations that caufe it, and the dimenfions of the vibrating body, came to be reduced to quantity, and as fuch was the fubject of calculation, and expreffible by numbers.—For inftance, the two founds that form an octave could be expreffed by the numbers 1 and 2, which would reprefent either the number of vibrations in a given time, or the length of the ftrings; and would mean, that the acuter found vibrates twice, while the graver vibrates once; or that the ftring producing the lower found is twice the length of that which gives the higher. If the vibrations were confidered, the higher found was as 2, the lower as 1; the reverfe, if the length was alluded to. In the fame manner, in the fame fenfe, the 5th would be expreffed by the ratio of 2 to 3, and the 4th by that of 3 to 4.

Ariftoxenus, in oppofition to the calculations of Pythagoras, held the ear to be the fole ftandard of mufical proportions. That fenfe he accounted fufficiently accurate for mufical, though not for mathematical, purpofes; and it was in his opinion abfurd to aim at an artificial accuracy in gratifying the ear beyond its own power of diftinction. He, therefore, rejected the velocities, vibrations, and proportions of Pythagoras as foreign to the fubject, in fo far as they fubftituted *abftract caufes* in the room of *experience*, and made mufic the object of *intellect* rather than of *fenfe*.

Of late, however, as has been already mentioned, the opinions of Pythagoras have been confirmed by abfolute demonftration; and the following propofitions, in relation to mufical found, have paffed from conjecture to certainty.

Sound is generated by the vibrations of elaftic bodies, which communicate the like vibrations to the air, and thefe again the like to our organs of hearing. This is evident, becaufe founding bodies communicate tremors to other bodies at a diftance from them. The vibrating motion, for inftance, of a mufical ftring, excites motion in others, whofe tenfion and quantity of matter difpofe their vibrations to keep time with the undulations of air propagated from it (the ftring firft fet in motion.)

If the vibrations be ifochronous, and the found mufical, continuing at the fame pitch, it is faid to be acuter, fharper, or higher, than any other found whofe vibrations are flower; and graver, flatter, or lower, than any other whofe vibrations are quicker.—For while a mufical ftring vibrates, its vibrations become quicker by increafing its tenfion or diminifhing its length; its found at the fame time will be more acute: and, on the contrary, by diminifhing its tenfion or increafing its length, the vibrations will become flower and the found graver. The like alteration of the pitch of the found will follow, by applying, by means of a weight, an equal degree of tenfion to a thicker or heavier and to a fmaller or lighter ftring, both of the fame length, as in the fmaller ftring the mafs of matter to be moved by the fame force is lefs.

If feveral ftrings, however, different in length, denfity, and tenfion, vibrate altogether in equal times, their founds will have all one and the fame pitch, however they may differ in loudnefs or other qualities.—They are called *unifons*. The vibrations of unifons are ifochronous.

The vibrations of a mufical ftring, whether wider or narrower, are nearly ifochronous. Otherwife, while the vibrations decreafe in breadth till they ceafe, the pitch of the found could not continue the fame (which we perceive by experience it does), unlefs where the firft vibrations are made very violently; in which cafe, the found is a little acuter at the beginning than afterwards.

Laftly, the word *vibration* is underftood to mean the time which paffes between the departure of the vibrating body from any affigned place and its return to the fame.

Glafs-Music. See HARMONICA.

MUSIMON, in natural hiftory, the name of an animal efteemed a fpecies of fheep, defcribed by the ancients as common in Corfica, Sardinia, Barbary, and the north-eaft parts of Afia. It has been doubted whether the animal defcribed under this name is now any where to be found in the world; and whether it was not, probably, a fpurious breed between two animals of different fpecies, perhaps the fheep and goat, which, like the mule, not being able to propagate its fpecies, the production of them may have been difcontinued.

Buffon fuppofes it to be the fheep in a wild ftate; and it is defcribed as fuch by Mr Pennant. Thefe animals live in the mountains, and run with great fwiftnefs among the rocks. Thofe of Kamtfchatka are fo ftrong, that 10 men can fcarce hold one; and the horns are fo large as fometimes to weigh 30 pounds, and

and fo capacious, that young foxes often fhelter themfelves in the hollow of fuch as by accident fall off in the deferts. See Ovis.

MUSIS (Agoftino de), a noted engraver, better known by the name of *Agoftino Veneziano*, or in England by that of "Auguftin the Venetian;" but *Mufis* was his proper family name. He was a native of Venice, and fcholar of Marc Antonio Raimondi. It is not certain at what period he begun his ftudies under that celebrated mafter; but the firft dated print by Agoftino appeared A. D. 1509, at which time, it is probable, his tutor ftill refided at Venice. After the death of Raphael, which happened in 1520, Agoftino de Mufis, and Marc de Ravenna, his fellow-difciple, who had conjointly affifted each other, feparated, and worked entirely upon their own account. It is uncertain at what time Agoftino died; but his prints are not dated later than 1536. So that it may be reafonably fuppofed that he did not long furvive that period. Agoftino de Mufis imitated the ftyle of his mafter with great attention, and was, upon the whole, the moft fuccefsful of all his fcholars. In neatnefs and mechanical execution with the graver, he has often equalled if not fometimes exceeded him; but in point of tafte, and in the purity and correctnefs of outline, he certainly fell greatly fhort of him. Agoftino's drawing had more of manner and ftiffnefs; the heads of his figures are not fo accurately marked; nor the other extremities expreffed with equal truth.

MUSIVUM AURUM. See CHEMISTRY, n° 1224.

MUSK, a very ftrong-fcented fubftance found under the belly of an Eaft Indian animal. See MOSCHUS.

According to Tavernier, the beft and greateft quantities of mufk come from the kingdom of Boutan, from whence it is carried for fale to Patna, the chief town of Bengal. After killing the animal, the peafants cut off the bag, which is about the fize of an egg, and is fituated nearer the organs of generation than the navel. They next take out the mufk, which has then the appearance of clotted blood. When they want to adulterate it, they put a mafh of the animal's blood and liver into the place of the mufk they had extracted. In two or three years this mixture produces certain fmall animals which eat the good mufk; fo that, when opened, a great confumption is perceived. Others, after extracting a portion of the mufk, put in fmall pieces of lead to augment the weight. The merchants who tranfport the mufk to foreign countries are lefs averfe to this trick than the former; becaufe in this cafe none of the animals abovementioned are produced. But the deceit is ftill worfe to difcover, when, of the fkin taken from the belly of a young animal, they make little bags, which they few fo dexteroufly with threads of the fame fkin, that they refemble genuine bags. Thofe they fill with what they take out of the genuine bags, and fome fraudulent mixture, which it is extremely difficult for the merchants to detect. When the bags are fewed immediately on their being cut, without allowing any part of the odour to diffipate in the air, after they have abftracted as much of the mufk as they think proper, if a perfon applies one of thefe bags to his nofe, blood will be drawn by the mere force of the odour, which muft neceffarily be weakened or diluted in order to render it agreeable without injuring the brain. Our author brought one of the animals with him to Paris, the odour of which was fo ftrong, that it was impoffible for him to keep it in his chamber. It made every head in the houfe giddy; and he was obliged to put it in a barn, where the fervants at laft cut away the bag: the fkin, notwithftanding, always retained a portion of the odour. The largeft mufk-bag feldom exceeds the fize of a hen's egg, and cannot furnifh above half an ounce of mufk: three or four of them are fometimes neceffary to afford a fingle ounce. In one of his voyages to Patna, Tavernier purchafed 1663 bags, which weighed 1557 ounces and a half; and the mufk, when taken out of the bags, weighed 452 ounces.

Mufk affords the ftrongeft of all known odours. A fmall bit of it perfumes a large quantity of matter. The odour of a fmall particle extends through a confiderable fpace. It is likewife fo fixed and permanent, that at the end of feveral years it feems to have loft no part of its activity. When it comes to us, it is dry, with a kind of unctuofity, of a dark reddifh-brown or rufty blackifh colour, in fmall round grains, with very few hard black clots, and perfectly free from any fandy or other vifible foreign matter. If chewed, and rubbed with a knife on paper, it looks fmooth, bright, yellowifh, and free from bitternefs. Laid on a red hot iron, it catches flame, and burns almoft entirely away, leaving only an exceeding fmall quantity of light greyifh afhes: if any earthy fubftances have been mixed with the mufk, the quantity of the refiduum will readily difcover them.

Mufk has a bitterifh fubacrid tafte; a fragrant fmell, agreeable at a diftance, but when fmelt near to, fo ftrong as to be difagreeable unlefs weakened by the admixture of other fubftances. If a fmall quantity be infufed in fpirit of wine in the cold for a few days, it imparts a deep, but not red tincture: this, though it difcovers no great fmell of the mufk, is neverthelefs ftrongly impregnated with its virtues; a fingle drop of it communicates to a whole quart of wine a rich mufky flavour. The degree of flavour which a tincture drawn from a known quantity of mufk communicates to vinous liquors, is perhaps one of the beft criteria for judging of the goodnefs of this commodity. Neumann informs us, that fpirit of wine diffolves 10 parts out of 30 of mufk, and that water takes up 12; that water elevates its fmell in diftillation, whilft pure fpirit brings over nothing.

Mufk is a medicine of great efteem in the eaftern countries; among us, it has been for fome time pretty much out of ufe, even as a perfume, on a fuppofition of its occafioning vapours, &c. in weak females and perfons of a fedentary life. It appears, however, from late experience, to be, when properly managed, a remedy of good fervice even againft thofe diforders which it has been fuppofed to produce. Dr Wall has communicated (in the Philofoph. Tranfac. n° 474.) an account of fome extraordinary effects of mufk in convulfive and other difeafes, which have too often baffled the force of medicine. The doctor obferves, that the fmell of perfumes is often of differvice, where the fubftance, taken inwardly and in confiderable quantity produces the happieft effects; that two perfons, labouring under a *fubfultus tendinum*, extreme anxiety, and want of fleep, from the bite of a mad dog,

dog, by taking two doses of musk, each of which was 16 grains, were perfectly relieved from their complaints. He likewise observes, that convulsive hiccups, attended with the worst symptoms, were removed by a dose or two of 10 grains; and that in some cases, where this medicine could not, on account of strong convulsions, be administered to the patient by the mouth, it proved of service when injected as a glyster. He likewise adds, that under the quantity of six grains, he never found much effect from it; but that, taken to 10 grains and upwards, it never fails to produce a mild diaphoresis, without at all heating or giving any uneasiness: that, on the contrary, it eases pain, raises the spirits; and that, after the sweat breaks out, the patient usually falls into a refreshing sleep: that he never met with any hysterical person, how averse soever to perfumes, but could take it, in the form of a bolus, without inconvenience. To this paper is annexed an account of some farther extraordinary effects of musk, observed by another gentleman. Repeated experience has since confirmed its efficacy in these disorders. The dose has sometimes been increased, particularly in convulsive disorders, to the quantity of a scruple or half a dram every three or four hours, with two or three spoonfuls of the musk julep between. The julep is the only officinal preparation of it. It is combined with opium in tetanus, and with mercury in rabies canina.

Musk-Animal. See Moschus.

Musk-Ox. See Bos.

Musk-Rat, in zoology. See Castor.

MUSKET, or Musquet, properly a fire-arm borne on the shoulder, and used in war; to be fired by the application of a lighted match.

The length of the barrel is fixed to three feet eight inches from the muzzle to the touch-pan, and its bore is to be such as may receive a bullet of 14 in a pound, and its diameter differs not above one 50th part from that of the bullet.

Muskets were anciently borne in the field by the infantry, and were used in England so lately as the beginning of the civil wars. At present they are little used, except in the defence of places; fusees or firelocks having taken their place and name.

MUSKETOON, a kind of short thick musket, whose bore is the 38th part of its length: it carries five ounces of iron, or seven and an half of lead, with an equal quantity of powder. This is the shortest kind of blunderbusses.

MUSLIN, a fine sort of cotton cloth, which bears a downy knot on its surface. There are several sorts of muslins brought from the East Indies, and more particularly from Bengal; such as doreas, betelles, mulmuls, tanjecbs, &c. Muslin is now manufactured in Britain, and brought to very great perfection.

MUSONIUS, (Caius Rufus), a Stoic philosopher of the second century, was banished into the island of Gyare, under the reign of Nero, for criticising the manners of that prince; but was recalled by the emperor Vespasian. He was the friend of Apollonius Tyanæus, and the letters that passed between them are still extant.

MUSQUETOE. See Culex.

MUSSULMAN, or Musulman, a title by which the Mahometans distinguish themselves; signifying, in the Turkish language, "true believer, or orthodox." See Mahometanism.

In Arabic, the word is written *Moslem*, *Mosleman*, or *Mosolman*. The appellation was first given to the Saracens, as is observed by Leunclavius.—There are two kinds of Mussulmans, very averse to each other; the one called *Sonnites*, and the other *Shiites*.—The Sonnites follow the interpretation of the Alcoran given by Omar; the Shiites are the followers of Ali. The subjects of the king of Persia are Shiites; and those of the grand signior, Sonnites. See Sonna, and Alcoran.

Some authors will have it, that the word Mussulman signifies *saved*, that is, predestinated; and that the Mahometans give themselves the appellation, as believing they are all predestinated to salvation.—Martininius is more particular as to the origin of the name; which he derives from the Arabic מסלם, *musalem*, "saved, snatched out of danger:" the Mahometans, he observes, establishing their religion by fire and sword, massacred all those who would not embrace it, and granted life to all that did, calling them *Mussulmans*, q. d. *erepti è periculo*; whence the word, in course of time, became the distinguishing title of all those of that sect, who have affixed to it the signification of *true believers*.

MUST, Mustum, sweet wine newly pressed from the grape; or the new liquor pressed from the fruit before it has worked or fermented. See Wine.

Must of Rhenish wine. This is a liquor that, tho' drank by some, is found extremely to affect the brain; for not having passed the natural effervescence which it would have been subject to, in the making of wine, its salts are locked up till the heat of the stomach setting them to work, they raise their effervescence there, and send up abundance of subtile vapours to the brain. The Rhenish must is of two kinds, being made either with or without boiling. That made without boiling is only put up so close in the vessel that it cannot work; this is called *stumm-wine*. That by boiling is thus prepared: they take strong vessels not quite filled, and putting them into a cellar, they make a fire mild at first, but increased by degrees, and afterwards they gradually lessen it again, that the boiling may cease of itself. This operation is finished in 36 or 40 hours, according to the size of the vessel; and the wine-boilers, instead of common candles, which would melt by the heat, use thin pieces of split beech-wood. These also serve for a double purpose, not only lighting them, but giving them notice of the boiling being enough; before that time, the quantity of vapours thrown up make them burn dim; but as soon as it is finished, the vapours ascend in less quantity, and the lights burn brisk and clear. About seven or eight days after this boiling, the must begins to work, and after this working it is called *wine*. They have also another kind of Rhenish must which is thus prepared: they boil the liquor to half the quantity, and put into it the medicinal ingredients they are most fond of; such as orange-peel, elecampane-root, and juniper-berries, or the like; being thus medicated, the whole works much more slowly than it otherwise would.—If the boiled must by too violent an effervescence cast out its lees, it will on this become vapid and dead, unless this separation is stopped by some fatty substance,

Muftard, Muftella.

ftance, fuch as frefh butter or the like: they put this in upon a vine leaf, or elfe apply hard to the mouth of the veffel.

A muft for artificial wine may be thus made: Take 20 pounds of fine fugar, five gallons of water, four ounces of white tartar finely pulverized, or cream of tartar, and boil them in a large veffel over a gentle fire.

MUSTARD. See Sinapi.

Mustard-Seed, is one of the ftrongeft of the pungent, ftimulating, diuretic medicines, that operate without exciting much heat. It is fometimes taken unbruifed, to the quantity of a fpoonful at a time, in paralytic, cachectic, and ferous diforders. It is applied alfo as an external ftimulant, to benumbed and paralytic limbs; to parts affected with fixed rheumatic pains; and to the foles of the feet, in the low ftage of acute difeafes, for raifing the pulfe; in this intention, a mixture of equal parts of the powdered feeds and crumbs of bread, with the addition fometimes of a little bruifed garlic, are made into a cataplafm with a fufficient quantity of vinegar. See Sinapism.

Muftard-feed yields upon expreffion, a confiderable quantity of oil, which is by fome recommended externally againft rheumatifms and palfies, though it has nothing of that quality by which the feeds themfelves prove ufeful in thofe diforders; the oil being mild and infipid as that of olives, and the pungency of the feed remaining entire in the cake left after expreffion; nor is any confiderable part of the pungent matter extracted by rectified fpirit. The bruifed feeds give out readily to water nearly the whole of their active matter: added to boiling milk they curdle it, and communicate their pungency to the whey. The powder of muftard-feed may be made into the confiftence of a loch with warm water, in which a little fea-falt has been diffolved. Of this a common fpoonful, fometimes two, diluted with tepid water, are given on an empty ftomach; it operates as well as an emetic, and proves an excellent remedy in moft nervous diforders, according to Dr Monro, in Med. Eff. Edinb. vol. ii. art. 19. p. 303. note.

MUSTELA, the Otter and Weasel; a genus of quadrupeds of the order of feræ. There are fix cutting teeth in each jaw; thofe of the upper jaw, erect, fharp-pointed, and diftinct; of the lower jaw, blunter, huddled together, and two placed within the line of the reft: The tongue is fmooth.

Plate CCCXXXIII

1. The lutris, or fea-otter, having hairy feet and a hairy tail. The length from nofe to tail is about three feet long, and the tail is about 13 inches; the body and the limbs are black, except the fore-part of the head, which is white or grey; the largeft individual weighs from 70 to 80 pounds; the fur is very thick, long, black, and gloffy, fometimes varying to filvery, with a foft down beneath. The fea-otter inhabits the coafts of North-weft America and Eaftern Afia, and the intermediate iflands. It lives moftly in the fea, and fwims with great facility; frequenting fhallows which abound in fea-weeds, and feeding on lobfters, fifh, *fepiæ* or cuttle-fifh, and fhell-fifh. It is a harmlefs animal; very affectionate to its young, infomuch that it will pine to death at the lofs of them, and die on the very fpot where they have been taken from it. Before the young can fwim, the dams carry them in their paws, lying in the water on their backs: they fwim often on their back, their fides, and even in a perpendicular pofture; are very fportive; embrace, and kifs each other: they breed but once a-year, and have but one young at a time, fuckle it for a year, and bring it on fhore. They are dull fighted, but quick-fcented; and run very fwiftly on land. They are hunted for their fkins, which are of great value; being fold to the Chinefe for 70 or 80 rubles a-piece: each fkin weighs 3½ lib. The young are reckoned very delicate meat, fcarce to be diftinguifhed from a fucking lamb. The cry of this creature is nearly fimilar to a young dog; and it is fometimes interrupted by another cry fimilar to that of the faki or fox-tailed monkey. It may be nourifhed with the flour of manioc diluted in water.

Muftella.

2. The lutra, or common otter, has naked feet, and the tail is about half the length of the body. It is in general about two feet long, from the tip of the nofe to the bafe of the tail. The fur is of a deep brown colour, with two fmall white fpots on each fide of the nofe, and one beneath the chin. This animal inhabits Europe, North America, and Afia as far fouth as Perfia. It frequents frefh-water rivers, lakes, and fifh-ponds; and preys on fifh, frogs, and frefh-water cruftaceous animals, being exceedingly deftructive to fifh-ponds. The otter procreates in February, and the female brings forth three or four young ones in May; the male calls the female by a foft murmuring noife. The otter fhows great fagacity in forming its habitation: it burrows under ground on the banks of fome river or lake: it always makes the entrance of its hole under water; working upwards to the furface of the earth, and forming, before it reaches the top, feveral holes or lodges, that, in cafe of high floods, it may have a retreat: for no animal affects lying drier at top: it makes a minute orifice for the admiffion of air. It is further obferved, that this animal, the more effectually to conceal its retreat, contrives to make even this little air-hole in the middle of fome thick bufh. Our author alfo informs us, that the otter is capable of being tamed; that he will follow his mafter like a dog, and even fifh for him, and return with his prey. Though the otter does not caft his hair, his fkin is browner, and fells dearer in winter than in fummer; and makes a very fine fur. His flefh has a difagreeable fifhy tafte. His retreats exhale a noxious odour from the remains of putrid fifhes; and his own body has a bad fmell. The dogs chace the otter fpontaneoufly, and eafily apprehend him when at a diftance from water or from his hole. But, when feized, he defends himfelf, bites the dogs moft cruelly, and fometimes with fuch force as to break their leg-bones, and never quits his hold but with life. The beaver, however, who is not a very ftrong animal, purfues the otters, and will not allow them to live on the fame banks with himfelf.

3. The lutreola, or fmall otter, has very broad hairy feet, and a white mouth; and feldom exceeds a foot in length. The body is of a tawny and dufky colour mixed together; the fur having two feries of hairs, the fhorter of which are yellowifh and the long black. This animal inhabits Poland, Finland, Ruffia, and Siberia; frequenting marfhy places, and preying on

Muſtela. on fiſh and frogs. It is caught with dogs and traps, and is exceſſively fetid; but its fur is very valuable, being eſteemed next in beauty to that of the fable.

Plate CCCXXXIII. 4. The canadenſis, or Canadian otter, is of a black colour, and the fur is ſmooth. It has a long taper tail; and inhabits Canada and other parts of North America.

5. The guianenſis, or ſmall Guiana otter, with the hind-feet webbed, the toes of the fore-feet unconnected, and a long taper naked tail, inhabits Cayenne, and probably other parts of South America. It is only about ſeven inches long from the noſe to the rump; the tail is near ſeven; the upper parts of the head and body are marked with large brownifh black ſpots, exactly correſponding on both ſides, and the intervals are of a yellowiſh grey colour; all the under parts of the body and head, and the fore-parts of the fore-legs, are white, and there is a white ſpot over each eye; the ears are large and round; and the mouth is garniſhed with long whiſkers. Buffon informs us that there are three ſpecies of otters in Cayenne: 1ſt, Black, which weighs from 40 to 50 French pounds. 2d, Yellowiſh, weighing 20 or 25 pounds. 3d, The ſmall greyiſh kind above deſcribed, which only weighs three or four pounds. The other two are not deſcribed; but they are ſaid to appear in numerous troops, to be very fierce and dangerous, and to defend themſelves againſt dogs, biting very cruelly: they litter in holes which they dig on the banks of rivers; are often tamed and brought up in houſes.

The otters, of which there are ſeveral more ſpecies deſcribed by authors, are diſtinguiſhed from the following tribe, the *weaſels*, by having their feet palmated or webbed; whereas the latter have their toes ſeparate, or unconnected by any web or membrane.

1. The galera, tayra, or Guinea weaſel, is of an uniform duſky colour, the fur very rough. It is about the ſize of a rabbit, and is ſhaped like a rat. It inhabits Guinea; where it burrows in the ground by means of its fore-feet, which are ſtrong and formed for digging. It is very common about the negro villages, and is exceedingly fierce and deſtructive to poultry.

2. The foina, or common martin, is of a blackiſh cheſnut colour, with the throat and breaſt white: the head and body meaſure 18 inches in length, the tail 10. The martin inhabits Britain, Germany, France, and moſt parts of the ſouth of Europe, and even the warmer parts of Ruſſia. He lives in woods, and goes about during the night in queſt of prey. He is a moſt elegant lively animal. His movements are all exceedingly nimble; he rather bounds and leaps than walks. He climbs rough walls with eaſe and alacrity; enters the pigeon or hen houſes, eats the eggs, pigeons, fowls, &c. and the female often kills great numbers, and tranſports them to her young. He likewiſe ſeizes mice, rats, moles, and birds in their neſts. M. Buffon kept one of theſe animals for a conſiderable time. He tamed to a certain degree, but never formed any attachment, and continued always ſo wild, that it was neceſſary to chain him. He made war againſt the rats, and attacked the poultry whenever they came in his way. He often got looſe, though chained by the middle of the body. At firſt he went to no great diſtance, and returned in a few hours; but without diſcovering any ſymptoms of joy or affection to any particular perſon. He, however, called for victuals like a cat or a dog. Afterwards he made longer excurſions; and at laſt he thought proper never to return. He was then about a year and a half old, ſeemingly the age at which nature aſſumes her full aſcendency. He eat every thing preſented to him, except ſallad and herbs; was fond of honey, and preferred hemp-ſeed to every other grain. It was remarked that he drank very often; that he ſometimes ſlept two days ſucceſſively, and at other times would ſleep none for two or three days; that, before ſleeping, he folded himſelf in a round form, and covered his head with his tail; and that, while awake, his motions were ſo violent, ſo perpetual, and ſo incommodious, that, though he had not diſturbed the fowls, it was neceſſary to chain him, to prevent him from breaking every thing. The ſame author informs us, that he has had in his poſſeſſion ſeveral martins of a more advanced age, which had been taken in nets; but they continued to be totally ſavage, bit all who attempted to touch them, and would eat nothing but raw fleſh. The character of this animal is ſomewhat differently given by Mr Pennant; who ſays "it is very *good-natured*, ſportive, and capable of being *tamed*." The younger females bring three or four at a birth; when older, they produce ſix or ſeven. They breed in hollows of trees; and are often, in winter, found in magpies neſts. The ſkin and excrements have a muſky ſmell.

3. The martes, or pine-martin, has the body of a dark or blackiſh cheſnut colour, the breaſt and throat yellow. It inhabits the north of Europe, Aſia, and America; and is more rarely found in Britain, France, Germany, and Hungary; and as far as Tonquin and China. They live in large woods or foreſts, keeping in the day-time in the hollows of trees, occupying ſquirrels neſts, eſpecially for their young, and go about only by night. They prey on ſquirrels, mice, rats, and ſmall birds; eat likewiſe berries, ripe fruit, and honey; and, in winter, go in queſt of pigeons and poultry. They procreate in February; and the female is ſaid, after nine months, to bring forth ſeven or eight young ones. The head of this ſpecies is ſhorter, and the legs are ſomewhat longer, than in the common martin. The fur is far ſuperior in fineneſs to that of the common kind, and is a prodigious article in commerce: Thoſe about Mount Caucaſus, with an orange throat, are more eſteemed by furriers than the reſt.

4. The Guiana or South American martin, is of a dark brown colour, with a white forehead, and a long narrow ſtripe along the ſide of the neck. The body and head are near two feet long, and the tail is only about five inches. It inhabits Guiana.

5. The laniger, woolly weaſel, or ſmall Guiana martin, is covered with white woolly hair, and has a long taper tail: the body and head are near 16 inches long, and the tail near 9. It inhabits Cayenne.

6. The zibellina, or ſable, has a great reſemblance to the martin: from which it differs in having a longer head; longer ears, ſurrounded by a yellow margin; longer and more elegant fur; the feet more thickly clothed with hair; and the tail ſhorter than the hind-legs when extended, while that of the martin is much longer. The colour of the hair is cinereous at the bottom, and black at the tips; the chin is cinereous, ſometimes white, yellowiſh, or ſpotted; the mouth is garniſhed with long whiſkers; and the feet are large, with white claws. It inhabits the northern parts of Aſia

Mustella. Asia and America, Siberia, Kamtschatka, and the Kurile islands, and formerly in Lapland; being found in Asia as low as 58°, and in America even to 40° of latitude. The sables frequent the banks of rivers and the thickest parts of the woods; avoiding the rays of the sun, which are said in a short time to change the colour of their hair. They live in holes of the earth, or beneath the roots of trees: sometimes they will form nests in the trees, and skip with great agility from one to the other: they are very lively, and much in motion during the night. Gmelin tells us, that after eating, they generally sleep half an hour or an hour, when they may be pushed, shaken, and even pricked, without awaking. During the night they are excessively active and restless. A tame one kept by Gmelin was accustomed to rise upon its hind-legs on sight of a cat, in order to prepare for the combat: In the woods they are much infested by wild cats. During summer the sables prey on ermines, weasels, and squirrels, but especially on hares; in winter, on birds; in autumn, on whortleberries, cranberries, and the berries of the service-tree: but during this last season their skins are at the worst; that diet causing their skins to itch, and to rub off their fur against the trees. They bring forth at the end of March or beginning of April; and have from three to five at a time, which they suckle for four or five weeks. In spring, after shedding the coat, the fur is sometimes of a tawny cast, and sometimes varies to snowy whiteness. The blackest are reputed the best; and sometimes sell, even in Siberia, from one to ten pounds Sterling each. See the article Sable.

Plate CCCXXXIII. 7. The putorius, or pole-cat, is of a dirty yellow colour, with white muzzle and ears. He inhabits most parts of Europe, and in the temperate climates of Asiatic Russia; and has a great resemblance to the martin in temperament, manners, disposition, and figure. Like the latter, he approaches our habitations, mounts on the roofs, takes up his abode in hay-lofts, barns, and unfrequented places, from which he issues during the night only in quest of prey. He burrows under ground, forming a shallow retreat about two yards in length, generally terminating under the roots of some large tree. He makes greater havock among the poultry than the martin, cutting off the heads of all the fowls, and then carrying them off one by one to his magazine. If, as frequently happens, he cannot carry them off entire, on account of the smallness of the entry to his hole, he eats the brains, and takes only the heads along with him. He is likewise very fond of honey, attacks the hives in winter, and forces the bees to abandon them. The females come in season in the spring; and bring forth three, four, or five at a time. In the desarts of Asiatic Russia, polecats are sometimes found, especially in winter, of a white colour; they are likewise found beyond lake Baikal with white or yellowish rumps, bounded with black. It is exceedingly fetid, like several other species of this genus, especially the martin and sable, giving out from the anus a most offensive vapour when frightened. The male is mostly of a yellowish tinge, having a whitish muzzle, while the muzzle of the female is commonly of a yellowish dirty white.

8. The furo, or ferret, has red and fiery eyes; the colour of the whole body is of a very pale yellow; the length from nose to tail is about 14 inches, the tail five. In its wild state it inhabits Africa: from thence it was brought into Spain, in order to free that country from multitudes of rabbits with which it was over-run; and from Spain the rest of Europe has been supplied. This creature is incapable of bearing the cold, and cannot subsist even in France unless in a domestic state. The ferret is not in our climates endowed with the same capacity of finding his subsistence as other wild animals, but must be carefully nourished within doors, and cannot exist in the fields; for those who are lost in the burrows of rabbits never multiply, but probably perish during the winter. Like other domestic animals, he varies in colour. The female ferret is less than the male; and when in season, we are assured, she is so extremely ardent, that she dies if her desires are not gratified. Ferrets are brought up in casks or boxes, where they are furnished with beds of hemp or flax. They sleep almost continually. Whenever they awake, they search eagerly for food; and brawn, bread, milk, &c. are commonly given them. They produce twice every year; and the female goes six weeks with young. Some of them devour their young as soon as they are brought forth, instantly come again in season, and have three litters, which generally consist of five or six, and sometimes of seven, eight, or nine. They are employed for hunting rabbits; and as in this country they are apt to degenerate, warreners are in use to cross the breed, procuring an intercourse between a female ferret and a male polecat, by leaving the former, when in season, near the haunts of the latter: The produce is of a much darker colour than the ferret, having a great resemblance to the polecat. This animal is by nature a mortal enemy to the rabbit. Whenever a dead rabbit is for the first time presented to a young ferret, he flies upon it, and bites it with fury; but if it be alive, he seizes it by the throat or the nose, and sucks its blood. When let into the burrows of rabbits, he is muzzled, that he may not kill them in their holes, but only oblige them to come out, in order to be caught in the nets. If the ferret is let in without a muzzle, he is in danger of being lost: for, after sucking the blood of the rabbit, he falls asleep; and even smoking the hole is not a certain method of recalling him; because the holes have often several entries which communicate with each other, and the ferret retires into one of those when incommoded with the smoke. Boys likewise use the ferret for catching birds in the holes of walls, or of old trees. The ferret, tho' easily tamed, and rendered docile, is extremely irascible: his odour is always disagreeable; but when he is irritated, it becomes much more offensive. His eyes are lively, and his aspect is inflammatory; all his movements are nimble; and he is at the same time so vigorous, that he can easily master a rabbit, tho' at least four times larger than himself.

9. The sarmatica, or Sarmatian weasel, is of a brownish black colour, spotted and striped irregularly with obscure yellow, and is about 14 inches in length, exclusive of the tail, which is six inches in length. It resembles the polecat, but has a narrower head, a more lengthened body, a longer tail, and shorter hair, except on the feet and tail; inhabits Poland, especially Volhynia, in the deserts of Russia between the Vólga and Tanais, the mountains of Caucasus, Georgia, and Bucharia.

Mustella. charia. This is a most voracious animal, which feeds on marmots, rats, mice, jerboas, birds, and other small animals. It procreates in spring, and after eight weeks the female, which has eight teats, brings forth from four to eight young ones. It lives in holes, sometimes of its own burrowing, but mostly in those which have been made by other animals, and is exceedingly fetid.

Plate CCCXXIII. 10. The vulgaris, or common weasel, foumart, or whitret, has the upper parts of the body of a pale reddish brown; the lower parts white. It inhabits the temperate and northern parts of Europe, Asia, and America, and as far to the southward as the northern provinces of Persia, and is said to be found even in Barbary. In the more northern parts of Russia and Sweden, particularly in Westbothnia, it becomes white in winter like the ermine; but even in this state it is easily distinguishable from the latter, being a great deal smaller; the body and head not exceeding seven inches long, and the tail two inches and a half. It is very destructive to young birds, poultry, and young rabbits; and is besides a great devourer of eggs. It does not eat its prey on the place; but, after killing it by one bite near the head, carries it off to its young, or to its retreat. It preys also on moles, as appears by its being sometimes caught in the mole-traps. It is a remarkably active animal; and will run up the sides of walls with such ease, that scarce any place is secure from it; and the body is so small, that there is scarce any hole but what is pervious to it.—This species is much more domestic than any of the rest, and frequents out-houses, barns, and granaries. It clears its haunt in a short time from mice and rats, being a much greater enemy to them than the cat itself. In summer, however, they retire farther from houses, especially into low grounds, about mills, along rivulets, concealing themselves among brush-wood, in order to surprise birds; and often take up their abode in old willows, where the female brings forth her young. She prepares for them a bed of straw, leaves, and other herbage, and litters in the spring, bringing from six to eight or more at a time. The young are born blind; but soon acquire sight and strength sufficient to follow their mothers. Their motion consists of unequal and precipitant leaps; and when they want to mount a tree, they make a sudden bound, by which they are at once elevated several feet high. They leap in the same manner when they attempt to seize a bird. These creatures, as well as the pole-cat and ferret, have a disagreeable odour, which is stronger in summer than in winter; and when pursued or irritated, their smell is felt at a considerable distance. They move always with caution and silence, and never cry but when they are hurt. Their cry is sharp, rough, and very expressive of resentment. As their own odour is offensive, they seem not to be sensible of a bad smell in other bodies. M. Buffon informs us, that a peasant in his neighbourhood took three new-littered weasels out of the carcase of a wolf that had been hung up on a tree by the hind-feet. The wolf was almost entirely putrefied, and the female weasel had made a nest of leaves and herbage for her young in the thorax of this putrid carcase. The weasel may be perfectly tamed, and rendered as caressing and frolicksome as a dog or squirrel. The method of taming them is to stroke them often and gently over the back; and to threaten, and even to beat them when they bite. In the domestic state their odour is never offensive but when irritated. They are fed with milk, boiled flesh, and water. Mustella.

11. The erminea, or ermine, has the tail tipt with black, and has been distinguished by authors into two varieties, the *stoat* and the *white ermine*, though the difference seems chiefly to depend on climate and the season of the year; the stoat of a pale tawny brown or reddish yellow colour in summer, becoming the white ermine of winter in cold countries. They inhabit the north of Europe, Asia, and America, and as far as the northern parts of Persia and China; living in heaps of stones on the banks of rivers, in the hollows of trees, and particularly in forests, especially those of beech, preying on squirrels and lemmings. In manners and food this animal resembles the common weasel, but does not frequent houses, haunting chiefly in woods and hedges, especially such as border on brooks or rivulets. In general appearance it comes very near to the martin, but is shorter in the body, being scarcely ten inches long from nose to rump, and the tail about five and a half; the hair is likewise shorter and less shining than in that animal. In the northern regions, the fur of the ermine becomes entirely white during winter, except the outer half of the tail, which remains black. The skin is reckoned valuable, and sells in Siberia from two to three pounds Sterling a-hundred; but in ancient times it was in much greater request than now. In summer, the upper part of the body is of a pale tawny brown colour; the edges of the ears, and ends of the toes, are yellowish white; the throat, breast, and belly are white; in winter, in the more temperate regions, it is sometimes mottled with brown and white; but in more severe winters becomes entirely white; the farther north and the more rigorous the climate, the white is the purer; those of Britain generally retain a yellowish tinge. In Persia and other more southern parts, it is brown the whole year. In Siberia they burrow in the fields, and are taken in traps baited with flesh. In Norway they are either shot with blunt arrows, or taken in traps made of two flat stones, one being propped up with a stick, to which is fastened a baited string, which when the animals nibble, the stone falls down and crushes them to death. The Laplanders take them in the same manner, only instead of stones make use of two logs of wood.

There are about 12 other species of the weasel tribe described by authors.—A beautiful species of *weasel*, as it is called by some authors and universally considered by the Arabians, is described by Mr Bruce in his Appendix under the name of *El Fennec*. It is about ten inches long from the snout to the tail; the tail near five inches and a quarter, and about half an inch of it black at the tip. From the point of the fore-shoulder to the point of the fore-toe it is two inches and seven eighths; from the occiput to the point of the nose, two inches and a half; and the ears are three inches and three eighths in length; and about an inch and a half in breadth, with the cavities very large. They are doubled, and have a plait on the outside; the border of the inside is thick and covered with white soft hair, the middle part being bare and of a rose or pink colour. The pupil of the eye

Mustella.

eye is large and black, surrounded with a deep blue iris; the mustachoes are thick and strong; the tip of the nose is very sharp, black, and polished. There are four grinders on each side of the mouth, six fore teeth in each jaw, and the upper jaw projected beyond the lower one. The canine teeth are large, long, and very sharp-pointed; the legs small, and the feet broad, with four toes armed with short, black, sharp retractile claws; those on the fore-feet being sharper than those behind. The whole body of the animal is of a dirty white, approaching to cream colour; the hair of the belly rather whiter, longer, and softer than the rest, with a number of paps upon it.

Mr Bruce obtained one of these animals for two sequins, by means of a janisary, who had it from a Turkish foot-soldier just returned from Biscara, a southern district of Mauritania Cæsariensis, now called the *Province of Constantina*. According to his account, they are not uncommon in this district, though more frequently to be met with in the neighbouring date-territories of Beni Mezab and Werglab, the residence of the ancient Melano-Gætuli. In the Werglab the animals are hunted for their skins, which are sold at Mecca, and afterwards exported to India. Mr Bruce kept this one for several months at his country-house near Algiers, that he might learn its manners. Its favourite food he tells us was dates or other sweet fruit, yet it is also very fond of eggs. It devoured those of pigeons and small birds with great avidity when first brought to him; but did not seem to know how to manage hen's eggs, though when they were broken to him he ate the contents with as great avidity as the others. When hungry, he would eat bread, especially with honey or sugar. His attention was greatly engrossed by the sight of any bird flying across the room where he was, or confined in a cage near him, and could not be diverted from viewing it by placing biscuit before him; so that it seems probable, that he preys upon them in his wild state. He was extremely impatient of having his ears touched; so that it was with much difficulty that they could be measured; and, on account of this impatience, it was found impossible to count the protuberances or paps on his belly. He seemed very much frightened at the sight of a cat; and endeavoured to hide himself, though he did not appear to meditate any defence. On this occasion also he lowered his ears, which at other times he kept erect. Notwithstanding his impatience, he would suffer himself, though with difficulty, to be handled in the day-time; but in the night he was extremely restless, always endeavouring to make his escape; and though he did not attempt the wire, yet with his sharp teeth he would soon have made his way through a wooden one, as two others which they attempted to bring along with him actually did. These animals are very swift of foot. They build their nests in trees, particularly the palms, of which they eat the fruit; feeding also on locusts and other insects, and perhaps sometimes preying upon small birds. Mr Bruce has a long criticism on Dr Sparmann for pretending that one Mr Brander was the discoverer of this animal; whereas he says that he himself gave it to Mr Brander. This is the same animal with that formerly described as a species of CANIS† under the name of *zerda*, and of which a figure is given in Plate CXX. Its exact place in the zoological system has not yet been ascertained.

† See *Canis*, n° xiv.

Muster || Mutilation.

MUSTER, in a military sense, a review of troops under arms, to see if they be complete and in good order; to take an account of their numbers, the condition they are in, viewing their arms and accoutrements, &c.

MUSTER-Master-general, or *Commissary-general of the MUSTERS*; one who takes account of every regiment, their number, horses, arms, &c. reviews them, sees the horses be well mounted, and all the men well armed and accoutred, &c.

MUSTER-Rolls, lists of soldiers in each company, troop, or regiment, by which they are paid, and the strength of the army is known.

MUTABILITY is opposed to immutability. See IMMUTABILITY.

MUTATION, the act of changing, or sometimes the change itself.

MUTATION, in the ancient music, is applied to the changes or alterations that happen in the order of the sounds which compose the melody.

MUTATIONES, among the Romans, post stages, or places where the public couriers were supplied with fresh horses.—The *mutationes* were wholly designed for the use of these couriers, or messengers of state; in which respect they differ from *mansiones*.

MUTCHKIN, a liquid measure used in Scotland; it contains four gills, and is the fourth part of a Scotch pint.

MUTE, in a general sense, signifies a person that cannot speak, or has not the use of speech.

MUTE, in law, a person that stands dumb or speechless, when he ought to answer, or to plead. See ARRAIGNMENT.

MUTE, in grammar, a letter which yields no sound without the addition of a vowel. The simple consonants are ordinarily distinguished into mutes and liquids, or semi-vowels. See the articles CONSONANT, LIQUID, &c.

The mutes in the Greek alphabet are nine, three of which, viz. π, κ, τ, are termed *tenues*; three β, γ, δ, termed *mediæ*; and three φ, χ, θ, termed *aspirates*. See the article ASPIRATE, &c.

The mutes of the Latin alphabet are also nine, viz. B, C, D, G, I, K, P, Q, T.

MUTILATION, the retrenching or cutting away any member of the body.

This word is also extended to statues and buildings, where any part is wanting, or the projecture of any member, as a cornice or an impost, is broken off. It is sometimes also used in a more immediate manner for castration: (See CASTRATION and EUNUCH). The practice of this sort of mutilation is of various kinds: The Hottentots are said to cut away one testicle from their children, upon supposition that they are thereby made lighter and more active for running. In other countries, poor people completely mutilate their boys, to prevent the misery and want which would attend their offspring. Those who have nothing in view but the improvement of a vain talent, or the formation of a voice which disfigures nature, as was the case formerly in Italy, are contented with cutting away the testicles. But in some countries of Asia, especially among the Turks and in a part of Africa, those whom jealousy

jealousy inspires with distrust, would not think their wives safe in the custody of such eunuchs: They employ no slaves in their seraglios who have not been deprived of all the external parts of generation.

Amputation is not the only means of accomplishing this end. Formerly, the growth of the testicles was prevented, and their organization destroyed, by simple rubbing, while the child was put into a warm bath made of a decoction of plants. Some pretend that by this species of castration the life is in no danger. Amputation of the testicles is not attended with much danger; but complete amputation of the external parts of generation is often fatal. This operation can only be performed on children from seven to ten years of age. Eunuchs of this kind, owing to the danger attending the operation, cost in Turkey five or six times more than others. *Chardin* relates, that this operation is so painful and dangerous after 15 years of age, that hardly a fourth part of those by whom it is undergone escape with life. *Pietro della Valle*, on the contrary, informs us, that in Persia those who suffer this cruel and dangerous operation as a punishment for rapes and other crimes of this kind, are easily cured though far advanced in life; and that nothing but ashes is applied to the wound.

There are eunuchs at Constantinople, throughout all Turkey, and in Persia, of a grey complexion: they come for the most part from the kingdom of Golconda, the peninsula on this side the Ganges, the kingdoms of Assau, Aracan, Pegu, and Malabar. Those from the gulph of Bengal are of an olive colour. There are some white eunuchs who come from Georgia and Circassia, but their number is small. The black eunuchs come from Africa, and especially from Ethiopia. These, in proportion to their horrible appearance, are the more esteemed and cost dearer. It appears that a very considerable trade is carried on in this species of men; for Tavernier informs us, that when he was in the kingdom of Golconda in the year 1657, 22,000 eunuchs were made in it. In that country they are sold at the fairs.

Eunuchs who have been deprived only of their testicles, continue to feel a titillation in what remains, and to have the external sign even more frequently than other men. But the part which remains is very small, and continues almost in the same state in which it was when the operation was performed during childhood.

If the different kinds of eunuchs are examined with attention, it will be found almost universally, that castration and its consequences have produced greater or less changes on their shape and appearance, independent of its physical effects.

Eunuchs, says M. Withof, are timid, irresolute, fearful, suspicious, and unsteady: And this seems to hold generally, though not universally, or without exceptions; (see the article Eunuch). The reason is, that their blood has not received all the necessary preparation in passing through the spermatic vessels. Thus being deprived of the properties of males, they participate of the dispositions of females, and their very soul is of an intermediate sex. They are not, however, without advantages: They become larger and fatter than other men; but they sometimes grow to a disgusting size. Though oily substances are more abundant in eunuchs, they are likewise less subject to gout and to madness than men who have a greater quantity of blood and of splenetic humours. The abundant circulation of oily liquor prevents roughness or inequalities in the trachea and palate. This, joined to the flexibility of the epiglottis and of the other organs of the voice, makes it so sonorous and extensive, and at the same time so sweet, that it is almost impossible for eunuchs to pronounce distinctly the letter R. Is this factitious advantage a sufficient consolation to these unhappy men for the barbarity of those who have dared to sacrifice nature at the shrine of avarice? It is impossible to reflect on all the motives for making eunuchs without a sigh of pity and regret; and yet it must not be supposed that this abominable cruelty is always infallibly attended with that advantage which is sometimes expected from it. Of 2000 victims to the luxury and extravagant caprices of the art, hardly three are found who unite good talents with good organs. The other languishing and inactive wretches, are outcasts from both sexes, paralytic members in the community, an useless burden upon the earth, by which they are supported and nourished. But let us pay the tribute which is due to that virtuous pontiff Pope Clement VIII. who, listening to the voice of modesty and humanity, proscribed and abolished this detestable and infamous practice. Mutilation he declared was the most abominable and disgraceful of crimes.

MUTILLA, in zoology, a genus of animals belonging to the order of insecta hymenoptera. There are 10 species; the most remarkable of which is the occidentalis, or velvet-ant, an inhabitant of North America. It has six legs, with short crooked antennæ; the abdomen large, with a black list crossing the lower part of it, and another black spot at the joining of the thorax; excepting which, the whole body and head resembles crimson-velvet. The trunk or shell of the body is of such a strong and hard contexture, that though trod upon by men and cattle they receive no harm. They have a long sting in their tails, which causes inflammation and great pain for half an hour to those who are stung by them; which usually happens to negroes and others that go barefooted. They are mostly seen running very nimbly on sandy roads in the hottest summer-weather; and always single. What they feed on, in what manner they breed, and where they secure themselves in winter, is unknown.

MUTINA (anc. geog.), a noble city of the Cispadana, made a Roman colony in the same year with Parma, situated between the rivers Gabellus and Scultenna, on the Via Æmilia. Here D. Brutus, being besieged by Antony, was relieved by the consuls Hirtius and Pansa. The Greeks called it *Mutine;* except Polybius, in whom it is *Motine;* and in Ptolemy *Mutina*, after the Roman manner.—Now *Modena*, a city of Lombardy, and capital of a cognominal duchy. E. Long. 11. 20. N. Lat. 44. 45.

MUTINY, in a military sense, to rise against authority.—"Any officer or soldier who shall presume to use traiterous or disrespectful words against the sacred person of his majesty, or any of the royal family, is guilty of mutiny.

"Any officer or soldier who shall behave himself with

Mutiny || Mutton.

with contempt or disrefpect towards the general or other commander in chief of our forces, or fhall fpeak words tending to their hurt or difhonour, is guilty of mutiny.

"Any officer or foldier who fhall begin, excite, caufe, or join in, any mutiny or fedition, in the troop, company, or regiment, to which he belongs, or in any other troop or company in our fervice, or on any party, poft, detachment, or guard, on any pretence whatfoever, is guilty of mutiny.

"Any officer or foldier who, being prefent at any mutiny or fedition, does not ufe his utmoft endeavours to fupprefs the fame, or coming to the knowledge of any mutiny, or intended mutiny, does not without delay give information to his commanding officer, is guilty of mutiny.

"Any officer or foldier who fhall ftrike his fuperior officer, or draw, or offer to draw, or fhall lift up any weapon, or offer any violence againft him, being in the execution of his office, on any pretence whatfoever, or fhall difobey any lawful command of his fuperior officer, is guilty of mutiny."

Mutiny-Act. See *Military-State.*

MUTIUS (Caius), furnamed *Codrus*, and afterwards *Scævola*, was one of the illuftrious Roman family of the Mutians, and rendered his name famous in the war between Porfenna king of Tufcany and the Romans. That prince refolving to reftore the family of Tarquin the Proud, went to befiege Rome 507 B. C. Mutius refolved to facrifice himfelf for the fafety of his country; and boldly entering the enemy's camp, killed Porfenna's fecretary, whom he took for Porfenna himfelf. Being feized and brought before Porfenna, he told him boldly, that 300 young men like himfelf had fworn to murder him; *but fince this hand has miffed thee*, continued he, *it muft be punifhed;* then putting his right hand on the burning coals, he let it burn with fuch a conftancy as aftonifhed the beholders. The king, amazed at the intrepidity of this young Roman, ordered that he fhould have his freedom and return to Rome, and foon after concluded a peace with the Romans. From this action Mutius obtained the furname of *Scævola*, "or left-handed," which was enjoyed by his family.

Mutius Scævola (Q.), furnamed the *Augur*, was an excellent civilian, and inftructed Cicero in the laws. He was made prætor in Afia; was afterwards conful, and performed very important fervices for the republic.

He ought not to be confounded with *Quintus Mutius Scævola*, another excellent civilian, who was prætor in Afia, tribune of the people, and at length conful, 95 B. C. He governed Afia with fuch prudence and equity, that his example was propofed to the governors who were fent into the provinces. Cicero fays, "that he was the moft eloquent orator of all the civilians, and the moft able civilian of all the orators." He was affaffinated in the temple of Vefta, during the wars of Marius and Sylla, 82 B. C.

MUTTON, the common name of the flefh of a fheep after the animal has been killed. Mutton has been commonly preferred to all the flefhes of quadrupeds. And indeed, befides its being more perfect, it has the advantage over them of being more generally fuited to different climates: whereas beef, *e. g.* requires a very nice intermediate ftate, which it feems to enjoy chiefly in England; for although Scotland fupplies what are reckoned the beft cattle, it is in the rich Englifh paftures that they are brought to perfection. Now the fheep can be brought almoft to the fame perfection in this bleak northern region as in the fouthern countries.

Mutual || Mya.

MUTUAL, a relative term, denoting fomething that is reciprocal between two or more perfons.

Thus we fay, *mutual affiftance, mutual averfion*, &c. There are mutual or reciprocal duties, offices, &c. between fuperiors and inferiors; as the king and his fubjects, the mafter and his fervants, &c.

Vaugelas makes a diftinction between *mutual* and *reciprocal: mutual*, according to him, is underftood of what is between two only; and *reciprocal*, of what is between more than two: but this diftinction is little regarded in common ufe.

MUTULE, in architecture, a kind of fquare modillion fet under the cornice of the Doric order.

MUTUNUS, or Mutinus (fab. hift.), a deity among the Romans, much the fame as the Priapus of the Greeks. The Roman matrons, and particularly newly married women, difgraced themfelves by the obfcene ceremonies which cuftom obliged them to obferve before the ftatue of this impure deity.

MUZZLE *of a* Gun *or* Mortar, the extremity at which the powder and ball is put in; and hence the muzzle-ring is the metalline circle or moulding that furrounds the mouth of the piece.

MYA, the gaper, in zoology; a genus belonging to the order of vermes teftacea, the characters of which are thefe. It has a bivalve fhell gaping at one end; the hinge, for the moft part, furnifhed with a thick, ftrong, and broad tooth, not inferted into the oppofite valve. Its animal is an Ascidia. The moft remarkable fpecies are.

1. The declivis, or floping mya, has a brittle half-tranfparent fhell, with a hinge flightly prominent near the open, and floping downwards. It inhabits the rivers of Europe. It is frequent about the Hebrides; the fifh eaten there by the gentry. Plate CCCXXXV. fig. 1.

2. The mya pictorum has an oval brittle fhell, with a fingle longitudinal tooth like a lamina in one fhell, and two in the other; the breadth is a little above two inches, the length one. It inhabits rivers. The fhells are ufed to put water colours in, whence the name. Otters feed on this and the other frefh-water fhells. Fig. 2.

3. The margaritifera, or pearl mya, has a very thick, coarfe, opaque fhell; often much decorticated; oblong, bending inward on one fide, or arcuated; black on the outfide; ufual breadth from five to fix inches, length two and a quarter. It inhabits great rivers, efpecially thofe which water the mountainous parts of Great Britain.—This fhell is noted for producing quantities of pearl. There have been regular fifheries for the fake of this precious article in feveral of our rivers. Sixteen have been found within one fhell. They are the difeafe of the fifh, analogous to the ftone in the human body. On being fqueezed, they will eject the pearl, and often caft it fpontaneoufly in the fand of the ftream. The river Conway was noted for them in the days of Cambden. A notion alfo prevails, that Sir Richard Wynne of Gwydir, chamberlain to Catharine Fig. 3. & 4.

Mya. rine queen to Charles II. presented her majesty with a pearl (taken in this river) which is to this day honoured with a place in the regal crown. They are called by the Welsh *cregin diluw*, or "deluge shells," as if left there by the flood. The Irt in Cumberland was also productive of them. The famous circumnavigator, Sir John Hawkins, had a patent for fishing in that river. He had observed pearls plentiful in the Straits of Magellan, and flattered himself with being enriched by procuring them within his own island. In the last century, several of great size were got in the rivers of the counties of Tyrone and Donegal in Ireland. One that weighed 36 carats was valued at 40l. but being foul, lost much of its worth. Other single pearls were sold for 4l. 10s. and even for 10l. The last was sold a second time to Lady Glenlealy, who put it into a necklace, and refused 80l. for it from the duchess of Ormond. Suetonius reports, that Cæsar was induced to undertake his British expedition for the sake of our pearls; and that they were so large that it was necessary to use the hand to try the weight of a single one. Mr Pennant supposes that Cæsar only heard this by report; and that the crystalline balls called *mineral pearl*, were mistaken for them. We believe that Cæsar was disappointed of his hope: yet we are told that he brought home a buckler made with British pearl, which he dedicated to, and hung up in, the temple of Venus Genetrix: a proper offering to the goddess of beauty, who sprung from the sea. It may not be improper to mention, that notwithstanding the classics honour our pearl with their notice, yet they report them to have been small and ill-coloured, an imputation that in general they are still liable to. Pliny says, that a red small kind was found about the Thracian Bosphorus, in a shell called *mya;* but does not give it any mark to ascertain the species.

Linnæus made a remarkable discovery relating to the generation of pearls in this fish.—It is a fish that will bear removal remarkably well; and it is said, that in some places they form reservoirs for the purpose of keeping it, and taking out the pearl, which, in a certain period of time, will be again renewed. From observations on the growth of their shells, and the number of their annular laminæ or scales, it is supposed the fish will attain a very great age; 50 or 60 years are imagined to be a moderate computation. The discovery turned on a method which Linnæus found, of putting these shell-fish into a state of producing pearls at his pleasure; though the final effect did not take place for several years: He says, that in five or six years after the operation, the pearl would have acquired the size of a vetch. We are unacquainted with the means by which he accomplished this extraordinary operation; but it was probably published at the time, and considered as important, since it is certain that the author was rewarded with a munificent premium from the states of the kingdom on this account. We regret that we cannot speak more fully on this head; but may observe, that it is probable, from a paper published many years afterwards in the Berlin Acts, that the method consisted in injuring the shell externally, perhaps by a perforation; as it has been observed, that these concretions in shell-fish are found on the inside, exactly opposite to perforations and injuries made from without by serpulæ and other animals.

Myagrum ‖ Mycetites

MYAGRUM, Gold of Pleasure, in botany: A genus of the siliculosa order, belonging to the tetradynamia class of plants; and in the natural method ranking under the 39th order, *Siliquosæ*. The silicula is terminated by an oblong style; the cell generally monospermous. There are five species; but the only remarkable one is the sativum, which grows naturally in corn-fields in the south of France and Italy, and also in some parts of Britain. It is an annual plant, with an upright stalk a foot and an half high, sending out two or four side-branches, which grow erect; the flowers grow in loose spikes at the end of the branches, standing upon short footstalks an inch long; they are composed of four small yellowish petals, placed in form of a cross; these are succeeded by oval capsules, which are bordered and crowned at the top with the style of the flower, having two cells filled with red seeds — This is cultivated in Germany for the sake of the expressed oil of the seeds, which the inhabitants use for medicinal, culinary, and œconomical purposes. The seeds are a favourite food with geese. Horses, goats, sheep, and cows, eat the plant.

MYCALE, a city and mountain of Caria; also a promontory of Asia opposite Samos, celebrated for a battle which was fought there between the Greeks and Persians about the year of Rome 275. The Persians were about 100,000 men, who had just returned from the unsuccessful expedition of Xerxes in Greece.—They had drawn their ships to the shore, and fortified themselves strongly, as if determined to support a siege. They suffered the Greeks to disembark from their fleet without the least molestation, and were soon obliged to give way before the cool and resolute intrepidity of an inferior number of men. The Greeks obtained a complete victory, slaughtered some thousands of the enemy, burned their camp, and sailed back to Samos with an immense booty, in which were 70 chests of money.

MYCENÆ (anc. geog.) a town of Argolus, in Peloponnesus. The kingdom of the Argives was divided into two portions by Acrisius and his brother Prœtus. Argos and Mycenæ were their capitals.—These, as belonging to the same family, and distant only about 50 stadia or six miles and a quarter from each other, had one tutelary deity, Juno, and were jointly proprietors of her temple, the Heræum, which was near Mycenæ. It was here that Agamemnon reigned. He enlarged his dominions by his valour and good fortune, and possessed, besides Mycenæ, the region about Corinth and Sicyon, and that called afterwards Achæa. On his return from Troy, he was slain with his companions at a banquet. Mycenæ then declined; and under the Heraclidæ was made subject to Argos. (See Argos and Argeia.) The Mycenæans, sending 80 men, partook with the Lacedæmonians in the glory acquired at Thermopylæ. The jealousy of the Argives produced the destruction of their city, which was abandoned after a siege, and laid waste in the first year of the 78th Olympiad, or 466 years before Christ. Some part of the wall remained in the second century, with a gate, on which were lions, a fountain, the subterraneous edifices where Atreus and his sons had deposited their treasures and, among other sepulchral monuments, one of Agamemnon, and one of his fellow-soldiers and sufferers.

MYCETITES discoides, in natural history, a name

Mycone || Mycteria.

name given by Dr Woodward to those kinds of fossile coralloide bodies which the generality of writers had called, after Dr Plott, *porpitæ*. These are usually small, and of a roundish, but flatted figure; they are hollowed on one side with a sort of umbilicus, and striated on the other; they are found on the ploughed lands in Oxfordshire, and some other of our midland counties, and in other places, buried in the solid strata of stone; they are sometimes yellowish, sometimes brownish, and are from the breadth of an inch to a fourth part or less of that size; when broken, they are usually found to consist of a kind of spar, not unlike that of which the shelly coats of the echinitæ, or the lapides indici, and other spines of echini consist in their fossile state; and in some of them the ridges and striæ are thick set with little knobs and tubercles. The basis in some of these is flat, as it is in others rising in form of a circular elevation from the umbilicus, and others have a circular cavity in the same place.

MYCONE, an island of the Archipelago, situated in E. Long. 25. 51. N. Lat. 37. 28. It is about 36 miles in circuit, and has a town of the same name, containing about 3000 inhabitants. The people of this island are said to be the best sailors in the Archipelago, and have about 150 vessels of different sizes. The island yields a sufficient quantity of barley for the inhabitants, and produces abundance of figs, and some olives; but there is a scarcity of water, especially in summer, there being but one well on the island.—There are a great number of churches and chapels, with some monasteries. The dress of the women in this island is very remarkable, and as different from that of the other islands as that of those islanders is different from the dress of the other European ladies. Their heads are adorned with lively-coloured turbans; their garments are a short white shift plaited before and behind, which reaches to their knees; they have white linen-drawers, and red, green, yellow, or blue stockings, with various coloured slippers. An ordinary suit for the better sort will cost 200 crowns.

MYCONUS (anc. geog.) one of the islands called Cyclades, near Delos, under which the last of the Centaurs slain by Hercules are feigned to lie buried. Hence the proverb, *Omnia sub unam Myconum congerere*, applied to an injudicious or unnatural farrago. Myconii, the people, noted for baldness. Hence Myconius, a bald person. According to Strabo, the inhabitants became bald at the age of 20 or 25; and Pliny says that the children were always born without hair. The island was poor, and the inhabitants very avaricious; whence Archilochus reproached a certain Pericles, that he came to a feast like a Myconian; that is, without previous invitation. Now called *Mycone*, an island in the Archipelago. E. Long. 25° 6′. Lat. 37°.

Plate CCCXXXV. MYCTERIA, the JABIRU, in ornithology; a genus of birds belonging to the order of grallæ. The bill is long, bending upwards, and acute; the nostrils are small and linear; there is no tongue; and the feet have four toes. There are two species: 1. The Americana, or American jabiru, is about the size of a turky. The bill is long, stout, and of a black colour: the whole plumage is white, except the head, and about two-thirds of the neck, which are bare of feathers and of a blackish colour; the remainder is also bare, and of a fine red; on the hind-head are a few greyish feathers; the legs are strong, of a great length, and covered with black scales; wings and tail even at the end. This bird is found in all the savannas of Cayenne, Guiana, and other parts of South America. It is migratory and gregarious. It makes its nest in great trees, which grow on the borders; lays two eggs, and brings up the young in the nest till they can descend to the ground. The colour of the young birds is grey; the second year it changes to rose-colour, and the third to pure white. They are very wild and voracious, and their food is fish, which they devour in great quantities. The flesh of the young birds is said to be good eating, but that of the old is hard and oily.

Mygdonia || Myagius.

2. The Asiatica, or Indian jabiru, is of a large size. The bill is dusky, almost straight above, and gibbous near the fore-head; the under mandible swelled beneath; and from the base of the bill there passes through and beyond the eye a black streak. The general colour of the plumage is white; the lower half of the back, the prime quills, and the tail, are black; the legs a pale red. This species inhabits the East Indies, and feeds on snails.

MYGDONIA (anc. geog.), a district of Macedonia, to the north of the Sinus Thermaicus, and east of the river Axius, which separates it from Bottiæis, and west of the river Strymon, (Pliny.) Also a district of Mesopotamia, which took its name from that of Macedonia, running along the Euphrates, from Zeugma down to Thapsacus, extending a great way east, because Nisibis was reckoned to it.

MYGINDA, in botany: A genus of the tetragynia order, belonging to the tetrandria class of plants; and in the natural method ranking with those of which the order is doubtful. The calyx is quadripartite; the petals four; the fruit a globose plum.

MYIAGRUS DEUS, in the heathen mythology, a name given sometimes to Jupiter, and sometimes to Hercules, on occasion of their being sacrificed to for the driving away the vast numbers of flies which infested the sacrifices on certain public occasions. The word is usually spelt *Myagrus*; but this must be an error, as this word does not express the *fly-destroyer*, but the *mouse-destroyer*; and we have it sufficiently testified by the ancients, that flies were the only creatures against whom this deity was invoked. Pliny calls this deity also *Myiodes*, and tells us, that the flies which used to pester the Olympic rites went away in whole clouds on the sacrificing a bull to this god. We find in Athenæus also, that this sacrificing to the god of flies at the Olympic games was a constant custom. Some distinguish these two deities, and tell us that the latter, or Myiodes, used to visit the nations in vengeance, with a vast multitude of flies; and that, on paying him the due honours of a sacrifice, they all went away again; and this seems to agree with what Pliny tells us in some places.

At the time of the Olympic games, Jupiter was worshipped under the name of the *Apomyos* or *Myiagrus Deus*, to supplicate the destruction of those troublesome creatures. This happened only once in many years, when the sacrifices were performed there; but the Elians worshipped him continually under this name, to deprecate the vengeance of heaven, which usually sent, as they expressed it, an army of flies and other insects,

toward the latter end of the fummer, that infefted the whole country with ficknefs and peftilence.

MYIODES deus, in the heathen mythology, a name fometimes given to Hercules, but more frequently to Jupiter, to whom a bull was facrificed, in order to make him propitious in driving away the flies that infefted the Olympic games.

MYLAE (anc. geog.) a Greek city fituated on an ifthmus of a cognominal peninfula, on the north-eaft fide of the ifland. *Mylaei*, or *Mylenfes*, the people. A town built by thofe of Zancle (Strabo.) Mylaeus, the epithet, as Mylæus Campus, mentioned by Polybius. Now called *Milazzo*, a port town of Sicily, in the Val di Demona. E. Long. 15° 5′. lat. 38. 36′.

MYLASA, or Mylassa, (anc. geog.), a noble city of Caria in Afia Minor, fituated at the diftance of about three leagues from the *Sinus Ceramicus*. It was the capital of Hecatomnus king of Caria, and father of Maufolus. Pliny fpeaks of Menander king of Caria, and fays that the Rhodians preferved with the greateft care his portrait painted by Apelles; but it was not in honour of this Menander that a Corinthian pillar was erected at Mylafa, which ftill exifts, and on which is to be feen the following infcription: "The people erected this pillar in honour of Menander, the fon of Uliades, and grandfon of Euthydemus, the benefactor of his country, and whofe anceftors rendered it great fervices alfo." Euthydemus, the grandfather of this Menander, lived in the time of Julius Cæfar and Auguftus. Caria was taken by Mithridates, and afterwards by Labienus, whofe father had been one of Cæfar's generals. Hybrias, whofe eloquence and valour defervedly intitled him to a diftinguifhed rank among his countrymen, in vain encouraged them to make a moft obftinate defence while it was befieged by the latter. He himfelf was obliged to yield to neceffity, and to take refuge at Rhodes: but fcarcely had the conqueror quitted the city, when Hybrias returned, and reftored liberty to his country. —Not content with rendering it this fervice, he alfo deftroyed the power of a dangerous citizen, whofe riches and talents rendered him a neceffary evil. Euthydemus, often banifhed, and as often recalled, always too powerful in a ftate the independence of which he threatened, faw his ambition checked by the zeal and activity of Hybrias. The Romans left to Mylafa that liberty of which it rendered itfelf fo worthy, by the great efforts it made to preferve it. Pliny calls it *Mylafa libera*. Strabo informs us, that it was one of the moft magnificent cities of antiquity, and one of thofe the temples, porticoes, and other public monuments of which were highly admired. A quarry of white marble in the neighbourhood furnifhed it with abundance of materials for erecting thefe edifices.— The Mylafians had two temples dedicated to Jupiter, one fituated in the city, which was named *Ofogo*, and another built on a mountain, at the diftance of 60 leagues. The latter was dedicated to *Jupiter Stratius*, Jupiter the Warrior. His ftatue, which was very ancient, infpired great veneration; people came from all quarters to implore his protection; and for the greater accommodation of his votaries a paved way was conftructed, which reached from Mylafa to this venerable fabric. This city is now called *Melaffo*, and, according to Dr Chandler, is ftill a large place.—he houfes are numerous, but chiefly of plafter, and mean, with trees interfperfed. The air is accounted bad; and fcorpions abound as anciently, entering often at the doors and windows, and lurking in the rooms. The plain is furrounded by lofty mountains, and cultivated. Round the town are ranges of broken columns, the remnants of porticoes, now with rubbifh bounding the vineyards. A large portion of the plain is covered with fcattered fragments, and with piers of ordinary aqueducts; befides infcriptions, moftly ruined and illegible. Some altars dedicated to Hecatomnus have been difcovered. Of all the ancient temples which formerly ornamented this city, one only efcaped the power of time, the blind zeal of the early Chriftians, and the barbarous fuperftition of the Mahometans. This monument was dedicated to Auguftus and the divinity of Rome. When Pococke vifited Melaffo, it was perfect and entire; but at prefent no traces of it remain, except a few fragments, which have been employed to conftruct a Turkifh mofque.

MYLOGLOSSUM, in anatomy. See Anatomy, *Table of the Mufcles.*

MYLOHYOIDÆUS. *Ibid.*

MYNSICHT (Hadrian), phyfician to the duke of Mecklenburgh and feveral other German princes, was diftinguifhed for his knowledge of chemiftry, at the beginning of the 17th century. He publifhed a work entitled *Armentarium Medico-Chymicum*, which has undergone various editions. In this work he gives a defcription of feveral medicines, about the virtues of which he is not always to be depended upon. To him we are indebted for a knowledge of the falt *de duobus* or the *Arcanum*, which is ftill in ufe.

MYOLOGY, (formed of μυς, μυος, "a mufcle," and λογος, "difcourfe"), in anatomy, a defcription of the mufcles; or the knowledge of what relates to the mufcles of the human body. See Anatomy, *Table of the Mufcles.*

MYOMANCY, a kind of divination, or method of foretelling future events by means of mice.

Some authors hold myomancy to be one of the moft ancient kinds of divination; and think it is on this account that Ifaiah, lxvi. 17. reckons mice among the abominable things of the idolators. But, befide that it is not certain that the Hebrew word עכבר ufed by the prophet fignifies *a moufe*, it is evident it is not the divination by that animal, be it what it will, that is fpoken of, but the eating it.

MYOPIA, Short-sightedness; a fpecies of vifion wherein objects are feen only at fmall diftances. See Medicine, n° 361.

MYOSOTIS, Scorpion-grass: A genus of the monogynia order, belonging to the pentandria clafs of plants; and in the natural method ranking under the 41ft order, *Afperifoliæ*. The corolla is falver-fhaped, quinquefid, and emarginated; the throat fhut up by fmall arches. There are four fpecies; of which the moft remarkable is the fcorpioides, or moufe-ear. This is a native of Britain, growing naturally in dry fields, and on the margins of fprings and rills. It hath naked feeds, and the points of the leaves callous. It varies confiderably in different fituations. In dry places the plant and flowers are fmaller; in moift ones both are larger, and fometimes hairy. The bloffoms vary

vary from a full blue to a very pale one, and ſometimes a yellow; and appear in a long ſpirally twiſted ſpike. When it grows in the water, and its taſte and ſmell is thereby rendered leſs obſervable, ſheep will ſometimes eat it; but it is generally fatal to them. Cows, horſes, ſwine, and goats refuſe it.

MYOSURUS, in botany: A genus of the polygynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 26th order *Multiſiliquæ*. The calyx is pentaphyllous, the leaves cohering at the baſe; there are five ſubulated nectaria reſembling petals: the ſeeds are numerous.

Plate CCCXVIII fig. 12. MYOXUS, the DORMOUSE, in zoology; a genus of quadrupeds belonging to the order of glires. There are two fore-teeth in each jaw; the upper ones cuneated, the under compreſſed: the whiſkers are long; the tail is hairy and round, growing thicker towards the extremity; the fore and hind legs are of equal length, and the fore-feet have four toes.

1. The glis, or hoary dormouſe, is of a pale aſh-colour on the upper parts of the body, and whitiſh on the under; and is about the ſize of the common ſquirrel, but thicker in the body. It inhabits France and the ſouth of Europe, and the ſouth-weſt of Ruſſia about the Volga of Samara. This animal, which is the ελειος of Ariſtotle, μυοξος of Oppian, and *glis* of Pliny, was held in great eſteem among the Romans, as a luxurious delicacy; they were fed in places called *gliriaria*, conſtructed for the purpoſe, and they are ſtill eaten by the modern Italians. It forms a neſt in the hollow of ſome tree, in which it ſleeps all day; feeds in the night on nuts, walnuts, the ſeeds of apples, &c. and grows very fat in autumn. About the month of October they gather in troops; and, retiring into ſubterranean burrows, remain torpid till near the end of May. The female has ten teats, ſix of which are ſituated on the breaſt, and four on the belly; and ſhe brings from nine to twelve young ones at a litter.

Fig. 14. 2. The nitella, or garden dormouſe, is of a tawny colour on the upper parts of the body, and whitiſh aſh-tinged with yellow on the under; has a black circle round each eye, and a black ſpot behind each ear; and is five inches long, beſides the tail which meaſures four. It inhabits the ſouth parts of Europe and Ruſſia, where it lives chiefly in gardens, though it ſometimes is found in houſes. They are very deſtructive to fruit, particularly peaches, which they ſeem to prefer to every other kind. They alſo eat peaſe, apricots, and plums; and when ſoft fruits are not to be had, they will eat almonds, filberts, nuts, and even leguminous plants. Of theſe they carry off great quantities into their retreats, which they dig in the earth, and particularly in well cultivated gardens; for in old orchards they are often found in hollow trees, where they make beds of herbs, moſs, and leaves. Eight or ten of them are frequently found in the ſame place, all benumbed, and rolled up in the midſt of their proviſion of fruits and nuts. They copulate in ſpring, and bring forth in ſummer. The litter conſiſts of five or ſix young, who grow very quickly, but are not fertile till the next year. Their fleſh is not eatable, but has the ſame diſagreeable odour with the domeſtic rat.

Fig. 3. 3. The muſcardinus, or common dormouſe, is about the ſize of the domeſtic mouſe, but of a plumper appearance; the noſe is more blunt; the head, ſides, belly, and tail, are of a tawny red colour, the throat white. Dormice inhabit woods, or very thick hedges; forming their neſts in the hollow of ſome low tree, or near the bottom of a cloſe ſhrub: they form little magazines of nuts, and eat in an upright poſture like the ſquirrel. The conſumption of their hoard, however, during the rigour of the ſeaſon is but ſmall; for they ſleep moſt of the time, retiring into their holes; at the approach of winter they roll themſelves up, and become torpid. Sometimes they experience a ſhort revival in a warm ſunny day, when they take a little food, and relapſe into their former ſtate. Theſe animals ſeldom appear far from their retreats, or in any open place; for which reaſon they ſeem leſs common in Britain than they really are. They make their neſts of moſs, graſs, and dead leaves; and bring uſually three or four young at a time.

MYREPSUS (Nicolas), was a phyſician of Alexandria, to whom we are under great obligations for the pains he took to collect, into a kind of pharmacopœia, all the compound medicines which lie ſcattered in the works of the Greeks and Arabian writers. his work was accompliſhed before the beginning of the 14th century; and though written in barbarous Greek, continued for a long time to be the rule of pharmaceutical preparations in Europe. A tranſlation of it into Latin by Leonard Fuſch is entitled *Opus Medicamentorum, in Sectiones quadraginta octo digeſtum.* There are a great many editions of this work: the beſt is that of Hartman Beverus, Nuremberg, 1658, 8vo.

MYRIAD, a term ſometimes uſed to denote ten thouſand.

MYRICA, GALE, or SWEET-WILLOW, in botany: A genus of the tetrandria order, belonging to the diœcia claſs of plants; and in the natural method ranking under the 5th order, *Amentaceæ*. The ſcale of the male catkin is in the form of a creſcent, without any corolla. The ſcale of the female catkin the ſame: there is no corolla; but two ſtyles, and a monoſpermous berry.

1. The gale, Dutch myrtle, or ſweet-willow, grows naturally upon bogs in many places both of Scotland and England. It riſes about four feet high, with many ſhrubby ſtalks, which divide into ſeveral ſlender branches, garniſhed with ſtiff ſpear-ſhaped leaves of a light yellowiſh green, ſmooth, and a little ſawed at their points. The female flowers or catkins are produced from the ſides of the branches, growing upon ſeparate plants from the female, which are ſucceeded by cluſters of ſmall berries, each having a ſingle ſeed. It flowers in July, and ripens in autumn. When tranſplanted into ſhrubberies, the moiſteſt parts muſt be aſſigned to it

The leaves, flowers, and ſeeds, of this plant, have a ſtrong fragrant ſmell, and a bitter taſte. They are ſaid to be uſed among the common people for deſtroying moths and cutaneous inſects, being accounted an enemy to inſects of every kind; internally, in infuſions, as a ſtomachic and vermifuge; and as a ſubſtitute to hops for preſerving malt liquors, which they render more inebriating, and of conſequence leſs ſalubrious: it is ſaid that this quality is deſtroyed by boiling.

2. The cerifera, wax-bearing myrica, or candleberry myrtle, is a native of North America. It is a fmall tree about ten or twelve feet high, with crooked ftems branching forth near the ground irregularly. The leaves grow irregularly on them all round; fometimes by pairs, fometimes alternately, but generally at unequal diftances. They are of a lanceolated figure; and fome are ferrated at the top, whilft others have their edges wholly entire. They ftand on very fhort footftalks; having their upper furface fmooth, and of a fhining green colour, whilft their under is of a more dufky hue. The branches of the old plants fhed their leaves in the autumn; but the young plants raifed from feeds retain them the greateft part of the winter, fo as during that feafon to have the appearance of an evergreen. But this beauty will not be lafting, for they fhed their leaves proportionally earlier as the plants get older. There are both male and female trees of this fort: The flowers are fmall, of a whitifh colour, and make no figure; neither does the fruit that fucceeds the female, which is a fmall, dry, blue berry, though produced in clufters, make any fhow: So that it is from the leaves this trees receives its beauty and value; for thefe being bruifed, as well as the bark of the young fhoots, emit the moft refrefhing and delightful fragrance, that is exceeded by no myrtle, or any other aromatic fhrub.

There is a variety of this fpecies of lower growth, with fhorter but broader leaves, and of equal fragrance. This grows commonly in Carolina; where the inhabitants collect from its berries a wax of which they make candles, and which occafions its being called the *candleberry tree*. It delights in a moiftifh foil. —The wax is procured in the following manner: In November and December, when the berries are ripe, a man with his family will remove from home to fome ifland or fand-bank near the fea, where thefe trees moft abound, taking with them kettles to boil the berries in. He builds a hut with palmetto leaves for the fhelter of himfelf and family during his refidence there, which is commonly four or five weeks. The man cuts down the trees, while the children ftrip off the berries into a porridge-pot; and having put water to them, they boil them till the oil floats, which is then fkimmed off into another veffel. This is repeated till no more oil appears. When cold, this hardens to the confiftence of wax, and is of a dirty green colour. Then they boil it again, and clarify it in brafs kettles; which gives it a tranfparent greennefs. Thefe candles burn a long time, and yield a grateful fmell. They ufually add a fourth part of tallow, which makes them burn clearer. Both the above forts may be propagated by feeds or layers. 1. The feeds of the candleberry-myrtle we receive from abroad; thofe of the fweet-gale from the bogs, where they grow in England or Scotland. The beft way is to fow them in boxes of earth from a rich pafture, well broken and fine. They fhould be fown about half an inch deep; and when the hot weather comes on, fhould be fet in the fhade. They will often remain until the fecond year before they come up, efpecially thofe feeds that come from abroad. If the boxes are fet in the fhade, and the plants come up, they will require no other trouble the firft fummer than keeping clean from weeds; in winter they fhould be removed to a warm hedge or wall, where they may enjoy the benefit of the fun. In the following fpring they will come up in plenty, In the beginning of May they fhould refume their fhady fituation; and this fummer they will require no other trouble than weeding and watering in dry weather. In the winter they fhould be removed into a well-fheltered place; and this may be repeated two years; when in the fpring they fhould be taken out of the boxes, and planted in the nurfery at about a foot afunder. 2. Thefe forts may be alfo eafily propagated by layers; for this operation being performed on the young wood in the autumn, will occafion them to fhoot good roots by the autumn following; many of which will be good plants, fit for any place. 3. Thefe plants may likewife be increafed by fuckers, for many of them often throw them out in vaft plenty; fo that thefe being taken out, the ftrongeft and beft rooted may be finally fet out; whilft the weaker, and thofe with lefs root, may be planted in the nurfery.

There are five other fpecies, *viz*. the *nagi*, or Japan myrica, with lanceolate entire veinlefs leaves, and berries about the fize of a cherry: the *ethiopica*, or willow-leaved myrica, with the leaves flightly ferrated; a native of Ethiopia: the *quercifolia*, with oblong leaves, finuated or notched on the fides, like the leaves of the oak; of which there are two varieties, the fmooth and the hairy, natives of the Cape of Good Hope: the trifoliata, or trifoliate myrica, with ternate leaves toothed on the edges; and the cordifolia, or heart-leaved myrica, with fubcordated, fawed, feffile leaves; both alfo natives of the Cape. Thefe are all tender plants, kept as curiofities in the greenhoufe, and difficult of propagation.

MYRIOPHYLLUM, in botany: A genus of the polyandria order, belonging to the monœcia clafs of plants; and in the natural method ranking under the 15th order, *Inundatæ*. The male calyx is tetraphyllous; there is no corolla; the ftamina are eight in number. The female calyx is tetraphyllous; the piftils four; there is no ftyle; and four naked feeds.

MYRISTICA, the Nutmeg-tree, in botany: A genus of plants belonging to the clafs diœcia, and order fyngenefia, in the *New Genera Plantarum* of Linnæus by *Shreber;* and of the natural order *Lauri*, in his fourth clafs *Monocotylidones*.—The male calyx is monophyllous, ftrong, and parted into three *lacinii* of an oval fhape, and ending in a point: it has no corolla. In the middle of the receptacle rifes a column of the height of the calyx; to the upper part of which the antheræ are attached. They vary in number from three to twelve or thirteen.—The female calyx and corolla as in the male, on a diftinct tree. The germen of an oval fhape; the ftyle fhort, with a bifid ftigma; the lacinii of which are oval and fpreading.—The fruit is of that fort called *drupa*. It is flefhy, roundifh, fometimes unilocular, fometimes bivalved, and burfts when ripe at the fide. The feed is enveloped with a flefhy and fatty membraneous fubftance, which divides into filaments (this, in one of the fpecies, is the mace of the fhops). The feed or nutmeg is round or oval fhaped, unilocular, and contains a fmall kernel, variegated on the furface by the fibres running in the form of a fcrew.

Species. There are five fpecies of this genus according

Myriftica. cording to fome authors; but feveral of thefe being only varieties, may be reduced to three, viz.

1. Myriftica fatua, or wild nutmeg: this grows in Tobago, and rifes to the height of an apple-tree; has oblong, lanceolated, downy leaves, and hairy fruit:—the nutmeg of which is aromatic, but when given inwardly is narcotic, and occafions drunkennefs, delirium, and madnefs, for a time. See a figure in *Gaerner de Sem* and *Fruct.* T. 41. f. 3. 4.

2. The myriftica febifera, (*Virola Sibifera Aublet*, page 904. Tab. 345.) A tree frequent in Guiana, rifing to 40 or even to 60 feet high; on wounding the trunk of which, a thick, acrid, red juice runs out. Aublet fays nothing of the nutmegs being aromatic; he only obferves, that a yellow fat is obtained from them, which ferves many œconomical and medical purpofes, and that the natives make candles of it.

3. The myriftica mofchata, or nutmeg, attains the height of 30 feet, producing numerous branches which rife together in ftories, and covered with bark, which of the trunk is a reddifh brown, but that of the young branches is of a bright green colour: the leaves are nearly elliptical, pointed, undulated, obliquely nerved, on the upper fide of a bright green, on the under whitifh, and ftand alternately upon footftalks: the flowers are fmall, and hang upon flender peduncles, proceeding from the axillæ of the leaves: they are both male and female upon feparate trees.

M. Schwaitz, who has carefully examined this as well as the two firft fpecies, preferved in fpirits, places them amongft the monodelphia.

The nutmeg has been fuppofed to be the *Comacum* of Theophraftus, but there feems little foundation for this opinion; nor can it with more probability be thought to be the *Chryfobalanos* of Galen. Our firft knowledge of it was evidently derived from the Arabians; by Avicenna it was called *jiaufiban*, or *jaufiband*, which fignifies nut of banda. Rumphius both figured and defcribed this tree; but the figure given by him is fo imperfect, and the defcription fo confufed, that Linnæus, who gave it the generic name *myriftica*, was unable to affign its proper characters.—Sonnerat's account of the *mufcadier* is ftill more erroneous; and the younger Linnæus was unfortunately mifled by this author, placing the myriftica in the clafs *Polyandria*, and defcribing the corolla as confifting of five petals. Thunberg, who examined the flower of the nutmeg, places it in the clafs *Monoecia*; and according to his defcription, the male flower has but one filament, furrounded at the upper part by the antheræ; and as the filaments are fhort and flender, and the antheræ united, this miftake might eafily arife. M. De La Marck informs us, that he received feveral branches of the myriftica, both in flower and fruit, from the Ifle of France, where a nutmeg-tree, which was introduced by Monfieur Poivre in 1770, is now very large, and continually producing flowers and fruit. From thefe branches, which were fent from Monf. Cere, director of the king's garden in that ifland, Monf. De La Marck has been enabled to defcribe and figure this and other fpecies of the myriftica with tolerable accuracy: and that we have profited by his labours, will appear from the annexed plate, of which the following is an explanation:

Plate CCCXXXIV. Fig. *a*. A fprig with fructification. The drupa of the natural fize, and burfting open. Fig. *b*. The full-grown fruit cut lengthways. Fig. *c*. Another fection of the fame. Fig. *d*. The nutmeg enveloped with its covering the mace. Fig. *e*. The fatty membrane or mace fpread out. Fig. *f*. The nutmeg of its natural fize. Fig. *g*. The fame with its external tegument removed at one end. Fig. *h*. The fame with its outer tegument entirely removed. Fig. *i*. A tranfverfe fection of the nutmeg. Fig. 1. and 2. Sprigs of the *Myriftica mofchata* in flower, with a leaf of the natural fize, and a reprefentation of the calyx and column in the flower. Plate CCCXXXV.

The feeds or kernels called *nutmegs* are well known, as they have been long ufed both for culinary and medical purpofes. Diftilled with water, they yield a large quantity of effential oil, refembling in flavour the fpice itfelf; after the diftillation, an infipid febacious matter is found fwimming on the water; the decoction infpiffated, gives an extract of an unuctous, very lightly bitterifh tafte, and with little or no aftringency. Rectified fpirit extracts the whole virtue of nutmegs by infufion, and elevates very little of it in diftillation; hence the fpirituous extract poffeffes the flavour of the fpice in an eminent degree.

Nutmegs, when heated, yield to the prefs a confiderable quantity of limpid yellow oil, which on cooling concretes into a febaceous confiftence. In the fhops we meet with three forts of unctuous fubftances, called *oil of mace*, though really expreffed from the nutmeg. The beft is brought from the Eaft Indies in ftone jars; this is of a thick confiftence, of the colour of mace, and has an agreeable fragrant fmell; the fecond fort, which is paler coloured, and much inferior in quality, comes from Holland in folid maffes, generally flat, and of a fquare figure: the third, which is the worft of all, and ufually called *common oil of mace*, is an artificial compofition of fevum, palm oil, and the like, flavoured with a little genuine oil of nutmeg.

Method of gathering and preparing Nutmeg. When the fruit is ripe, the natives afcend the trees, and gather it by pulling the branches to them with long hooks. Some are employed in opening them immediately, and in taking off the green fhell or firft rhind, which is laid together in a heap in the woods, where in time it putrefies. As foon as the putrefaction has taken place, there fpring up a kind of mufhrooms, called *boleti mofchatyni*, of a blackifh colour, and much valued by the natives, who confider them as delicate eating. When the nuts are ftripped of their firft rhind they are carried home, and the mace is carefully taken off with a fmall knife. The mace, which is of a beautiful red, but afterwards affumes a darkifh or reddifh colour, is laid to dry in the fun for the fpace of a day, and is then removed to a place lefs expofed to his rays, where it remains for eight days, that it may foften a little. They afterwards moiften it with fea-water, to prevent it from drying too much, or from lofing its oil. They are careful, however, not to employ too much water, left it fhould become putrid, and be devoured by the worms. It is laft of all put into fmall bags, and fqueezed very clofe. Mace muft not be confounded with *macer*. See the word Macer.

The nuts, which are ftill covered with their ligneous fhell, are for three days expofed to the fun, and afterwards

Myristica afterwards dried before a fire till they emit a found when they are fhaken; they then beat them with fmall fticks in order to remove their fhell, which flies off in pieces. Thefe nuts are diftributed into three parcels; the firft of which contains the largeft and moft beautiful, which are deftined to be brought to Europe; the fecond contains fuch as are referved for the ufe of the inhabitants; and the third contains the fmalleft, which are irregular or unripe. Thefe are burnt; and part of the reft is employed for procuring oil by preffure. A pound of them commonly gives three ounces of oil, which has the confiftence of tallow, and has entirely the tafte of nutmeg. Both the nut and mace, when diftilled, afford an effential, tranfparent, and volatile oil, of an excellent flavour.

The nutmegs which have been thus felected would foon corrupt if they were not watered, or rather pickled, with lime-water made from calcined fhell-fifh, which they dilute with falt-water till it attain the confiftence of fluid pap. Into this mixture they plunge the nutmegs, contained in fmall bafkets, two or three times, till they are completely covered over with the liquor. They are afterwards laid in a heap, where they heat, and lofe their fuperfluous moifture by evaporation. When they have fweated fufficiently, they are then properly prepared, and fit for a fea-voyage.

In the ifland of Banda, the fruit of the nutmeg-tree is preferved entire in the following manner: When it is almoft ripe, but previous to its opening, it is boiled in water and pierced with a needle. They next lay it in water to foak for ten days, till it has loft its four and fharp tafte. They then boil it gently in a fyrup of fugar, to which, if they wifh it to be hard, a little lime is added. This operation is repeated for eight days, and each time the fyrup is renewed. The fruit when thus preferved is put for the laft time into a pretty thick fyrup, and is kept in earthen pots clofely fhut.

Thefe nuts are likewife pickled with brine or with vinegar; and when they intend to eat them, they firft fteep them in frefh water, and afterwards boil them in fyrup of fugar, &c.

Ufes. Nutmegs preferved entire are prefented as deferts, and the inhabitants of India fometimes eat them when they drink tea. Some of them ufe nothing but the pulp; others likewife chew the mace; but they generally throw away the kernel, which is really the nutmeg. Many who perform fea-voyages to the north chew this fruit every morning.

The medicinal qualities of nutmeg are fuppofed to be aromatic, anodyne, ftomachic, and reftringent; and with a view to the laft mentioned effects, it has been much ufed in diarrhœas and dyfenteries. To many people the aromatic flavour of nutmeg is very agreeable; they however fhould be cautious not to ufe it in large quantities, as it is apt to affect the head, and even to manifeft an hypnotic power in fuch a degree as to prove extremely dangerous. Bontius fpeaks of this as a frequent occurrence in India; and Dr Cullen relates a remarkable inftance of this foporific effect of the nutmeg, which fell under his own obfervation, and hence concludes, that in apoplectic and paralytic cafes this fpice may be very improper. He obferves, that a perfon by miftake took two drams or a little more of powered nutmeg: he felt it warm in his ftomach, without any uneafinefs; but in about an hour after he had taken it he was feized with a drowfinefs, which gradually increafed to a complete ftupor and infenfibility; and not long after he was found fallen from his chair, lying on the floor of his chamber in the ftate mentioned. Being laid a-bed he fell afleep; but waking a little from time to time, he was quite delirious; and he thus continued alternately fleeping and delirious for feveral hours. By degrees, however, both thefe fymptoms diminifhed; fo that in about fix hours from the time of taking the nutmeg he was pretty well recovered from both. Although he ftill complained of head-ach, and fome drowfinefs, he flept naturally and quietly the following night, and next day was quite in his ordinary health.

The officinal preparations of nutmeg are a fpirit and effential oil, and the nutmeg in fubftance roafted, to render it more aftringent. Both the fpice itfelf and its effential oil enter feveral compofitions, as the confectio aromatica fpiritus amoniæ com. &c. Mace poffeffes qualities fimilar to thofe of the nutmeg, but is lefs aftringent, and its oil is fuppofed to be more volatile and acrid.

Remarks on the Trade of Nutmegs. Nutmeg-trees grow in feveral iflands in the eaftern ocean. The wood-pigeon of the Moluccas is unintentionally a great planter of thefe trees, and diffeminates them in places where a nation, powerful by its commerce, thinks it for its intereft that they fhould be rooted out and deftroyed. The Dutch, whofe unwearied patience can furmount the greateft obftacles, have appropriated to themfelves the crop of nutmeg, as well as that of cloves and cinnamon, growing in the iflands of Ternate, Ceylon, &c. either by right of conqueft or by paying fubfidies to the iflanders, who find thefe much more profitable than the former produce of their trees. It is neverthelefs true, that they have prevailed upon or compelled the inhabitants of the Moluccas to cut down and root out all the clove-trees, which they have preferved only in the iflands of Amboina and Ternate, which are in a great meafure fubject to them. We know for certain, that the Dutch pay 18,000 rixdollars yearly to the king of Ternate, by way of tribute or gift, in order to recompence him for the lofs of his clove-trees in the other Molucca iflands; and that they are moreover bound by treaty to take at 3¼d. a pound, all the cloves brought by the natives of Amboyna to their magazines. They have likewife fucceeded to deftroy the cinnamon every where except in the ifland of Ceylon, which is in their poffeffion. The fame is the cafe with white pepper, &c. fo that the trade of the whole of Europe, and of great part of Afia in this fpecies of commodity, paffes through their hands.

The Dutch have immenfe and very rich magazines of thefe precious aromatics, both in India and Europe. They have actually by them the produce of 16 years, and never fupply their neighbours with the laft, but always with the oldeft crop: in 1760 they fold what was laid up in 1744. It is commonly faid, that when the Dutch have too great a quantity of cloves, nutmeg, &c. in their magazines, they throw them into the fea; but the fact is, that they get rid of their fuperfluous aromatics by burning them. On the

Myrmecophaga.

the 10th of June 1760, M. Beaumare ſaw at Amſterdam, near the Admiralty, a fire, the fuel of which was valued at 8,000,000 of livres; and as much was to be burned on the day following. The feet of the ſpectators were bathed in the eſſential oil of theſe ſubſtances; but no perſon was allowed to gather any of it, much leſs to take any of the ſpices which were in the fire. Some years before, upon a ſimilar occaſion, and at the ſame place, a poor man who had taken up ſome nutmegs which had rolled out of the fire, was, as M. Beaumare was informed, ſeized and condemned to immediate execution. We will only add, that notwithſtanding the jealouſy of the Dutch, and the pains they take to preſerve the ſale of cloves wholly to themſelves, they have never been able to prevent their own officers in ſeveral parts of India from embezzling and ſelling conſiderable quantities of them. M. de Jaucourt informs us, that in order to defraud the company, they ſell them to the veſſels of other nations which they meet at ſea, and moiſten the remainder with water, that they may ſtill have the number of quintals of which their cargo conſiſted. The quantity ſold may amount to 10 quintals in 100 before it can be perceived by the clerks of the magazines at Batavia, where they are received.

We are informed by M. Romé de Liſle, who has lately arrived from India, that the Engliſh draw a great deal of cinnamon, pepper, and cloves, from the iſland of Sumatra. The ſtaple for this commodity, which gives great offence to the Dutch, is at the factory of Bencoolen. We have likewiſe ſeen a ſpecimen of pretty good cinnamon raiſed at Martinico.—The French, to prevent the exportation of ſpecie for theſe aromatic and exotic productions, have attempted to introduce the culture of them into ſome of their colonies. A great many plants of the clove and nutmeg-tree have been procured, and planted in the Iſle of France, the iſland of Bourbon, and alſo at Cayenne, where they have a very promiſing appearance.

Plate cccxxxvi.

MYRMECOPHAGA, or Ant-bear, in zoology; a genus of quadrupeds, belonging to the order of bruta: There are no teeth in the mouth; the tongue is long and cylindrical; the head terminates in a long ſnout or muzzle; and the body is covered with pretty long hair. There are five ſpecies, viz.

1. The didactyla, or little ant-bear, hath a conic noſe bending a little down; ears ſmall, and hid in the fur; two hooked claws on the fore-feet, the exterior being much the largeſt; four on the hind-feet; the head, body, limbs, and upper part and ſides of the tail, covered with long ſoft ſilky hair, or rather wool, of a yellowiſh brown colour: from the noſe to the tail it meaſures ſeven inches and an half; the tail eight and an half, the laſt four inches of which on the under ſide are naked. It is thick at the baſe, and tapers to a point. It inhabits Guinea, climbs trees in queſt of a ſpecies of ants which build their neſts among the branches: has a prehenſible power with its tail.

2. The tridactyla, tamandua-guaca, or tamanoir, has three toes on the fore-feet, five on the hind-feet, and long hair on the tail. This animal is about four feet long, and the head and ſnout about 15 inches: it is a native of the Eaſt Indies, and feeds on ants, &c. in the ſame manner as the former.

Myrmecophaga, Myrmeleon.

3. The jubata, or great ant-bear, has a long ſlender noſe, ſmall black eyes; ſhort round ears; a ſlender tongue two feet and an half long, which lies double in the mouth; the legs ſlender; four toes on the fore-feet, five on the hind-feet; the two middle claws on the fore-feet very large, ſtrong, and hooked; the hair on the upper part of the body is half a foot long, black mixed with grey; the fore-legs are whitiſh, marked above the feet with a black ſpot; the tail is clothed with very coarſe black hair a foot long: the length from the noſe to the tail about four feet; the tail two feet and an half. This animal inhabits South America, and the kingdom of Congo in Africa. It covers itſelf with its tail when aſleep and to guard againſt rain. Its fleſh is eaten by the natives of America.

4. The tetradactyla, or middle ant-bear, has four toes on the fore-feet, and five on the hind, with a tail naked at the extremity; the length from the noſe to the tail is one foot ſeven inches, and the tail ten inches. It inhabits South America.

5. The capenſis, or Cape ant-bear, has four claws on the fore-paws; a long ſnout; large pendent ears; and a tail, which is ſhorter than the body, and taper at the point. It inhabits the country at the Cape of Good Hope.—This animal is much larger than the other ſpecies of the genus, ſo that Kolben compares it to the ſize of a hog, and aſſerts that it weighs 100 pounds. It burrows in the ground, ſleeps during the day, and only goes abroad at night.

Theſe animals have many properties in common with each other, both in their ſtructure and manners. They all feed upon ants, and plunge their tongues into honey and other liquid or viſcid ſubſtances. They readily pick up crumbs of bread, or ſmall morſels of fleſh. They are eaſily tamed, and can ſubſiſt for a long time without food. They never ſwallow all the liquor which they take for drink; for a part of it falls back through their noſtrils. They run ſo ſlowly, that a man may eaſily overtake them in an open field.—Their fleſh, though its taſte be very diſagreeable, is eaten by the ſavages. At a diſtance the great ant-eater has the appearance of a fox; and for this reaſon ſome travellers have given him the name of the *American fox*. He has ſtrength ſufficient to defend himſelf from a large dog, or even from the jaquar or Braſilian cat. When attacked, he at firſt fights on end, and, like the bear, annoys his enemy with the claws of his fore-feet, which are very terrible weapons.—He then lies down on his back, and uſes all the four feet, in which ſituation he is almoſt invincible; and continues the combat to the laſt extremity. Even when he kills his enemy, he quits him not for a long time after. He is enabled to reſiſt better than moſt other animals, becauſe he is covered with long buſhy hair; his ſkin is remarkably thick; his fleſh has little ſenſation; and his principle of life is very tenacious.

MYRMELION, or Ant-lion, in zoology; a genus of inſects of the nemopteca order. There are 15 ſpecies, of which the moſt remarkable is the formicarius, or ant-eater. The perfect inſect is oblong, and of a brown colour. Its head is broad, with two large eyes on the ſides, and two antennæ beneath. The neck is rather long, cylindrical, and narrower than the head. The thorax ſeems compoſed of two parts; one ante-

Myrmelion, Myrmidons.

rior, whence arife the upper wings; and the other pofterior, which gives birth to the under ones. The abdomen is of an oblong form, and confifts of eight fegments; the wings are diaphanous, adorned with a net-work of black fibres, charged with feveral blackifh brown fpots. The larva of this infect is very fond of ants, which it hunts after, whence its name. The larvæ proceed from the egg which the perfect infect had depofited in very fine dry fand, in a place fheltered from rain, either within a cleft of a wall or of the ground, or at the foot of a wall generally expofed to the fouth fun. There they are hatched, and make their ufual abode. Their colour is grey, and their body, which is covered with fmall protuberances, is of an oval form. Its pofterior extremity terminates in a point, and is of ufe to fink itfelf down into the fand; for it only walks retrogreffively, though furnifhed with fix feet. Before the head is placed a dentated forceps, fharp and hollow within, with which the creature catches and fucks flies and other infects, but efpecially ants. This forceps ferves as a mouth or roftrum, as well as for an offenfive weapon. The animal's retrograde march not allowing it to run after the infects on which it is to feed, it ufes a ftratagem. It dives down into the fand, and turning about in a circle, hollows out concentric furrows, gradually deeper and deeper, cafting at a diftance with its horns the fand it takes from that place. At length it manages to dig a hole in fhape like a funnel, at the bottom of which it takes its ftation, concealed in the fand, nothing but the open extended forceps appearing above it. Mifchief overtakes every infect that happens to fall into that hole. The myrmelio, who is apprized of it by the grains of fand rolling down to the bottom, overwhelms him with a fhower of duft, which it ejects with its horns, then drags the infect to the bottom of the hole, where it feizes him with its forceps, and fucks its vitals. It does not even fpare other myrmelions who in their motions to and fro chance to fall into it. When the larva is come to its full growth, it digs no more holes; it moves backwards and forwards, tracing irregular furrows on the fand, and at length fpins itfelf a cod, fhaped like a ball, the outward part of which is formed of the fand in which it lived, and the inward is lined with fine white filk. Within this cod it turns to a chryfalis, which is curved into a femicircle, and wherein may be diftinguifhed all the parts of the perfect infect that is to iffue from it. It is more oblong than the larva, but much fhorter than the perfect infect. After a certain period, the chryfalis cafts off its flough, turns to a winged infect, and breaks through the cod in order to take its flight. The perfect infect is very fcarce, but is fometimes met with in fandy places, and near rivulets.

Barbut's Genera of Infects, p 223.

MYRMIDONS (Myrmidones), in antiquity; a people on the fouthern borders of Theffaly, who accompanied Achilles to the Trojan war. They received their name from Myrmidon, a fon of Jupiter and Eurymedufa, who married one of the daughters of Æolus, fon of Helen. His fon Actor married Ægina the daughter of Afopus. He gave his name to his fubjects, who dwelt near the river Peneus in Theffaly. According to fome, the Myrmidons received their name from their having arifen from ants or pifmires, upon a prayer put up for that purpofe by king Æacus to Jupiter, after his kingdom had been difpeopled by a fevere peftilence. According to Strabo, they received it from their induftry, becaufe they imitated the diligence of the ants, and like them were indefatigable, and were continually employed in cultivating the earth.

Myrmillones ‖ Myroxylon.

MYRMILLONES were gladiators of a certain kind at Rome, who fought againft the Retiarii. Their arms were a fword, head-piece, and fhield. On the top of the head-piece they wore a fifh emboffed, called Μορμυρος, whence their name is by fome fuppofed to be derived. The Retiarii, in their engagements, made ufe of a net, in which they endeavoured to entangle their adverfaries, and fung during the fight, "*Non te peto, pifcem peto; quid me fugis, Galle?*" "I aim not at thee, but I aim at thy fifh; why doft thou fhun me, O Gaul?" The Myrmillones were called Galli, becaufe they wore Gallic armour. They were alfo named *Secutores*. This kind of gladiators was fuppreffed by Caligula. See Gladiators, Retiari, &c.

MYROBALANS, a kind of medicinal fruit brought from the Indies, of which there are five kinds. 1. The citrine, of a yellowifh red colour, hard, oblong, and the fize of an olive. 2. The black, or Indian myrobalan, of the bignefs of an acorn, wrinkled, and without a ftone. 3. Chebulic myrobalans, which are of the fize of a date, pointed at the end, and of a yellowifh brown. 4. Emblic, which are round, rough, the fize of a gall, and of a dark brown. 5. Balleric, which are hard, round, of the fize of an ordinary prune, lefs angular than the reft, and yellow. They are all flightly purgative and aftringent. The word comes from the Greek μυρον, "ointment," and βαλανος, "acorn," as being in the form of acorns, and ufed in medicine.

MYRON, an excellent Grecian ftatuary, flourifhed 442 B. C. The cow he reprefented in brafs was an admirable piece of workmanfhip, and was the occafion of many fine epigrams in Greek.

MYROXYLON, in botany: A genus of the monogynia order, belonging to the decandria clafs of plants. The calyx is campanulated; the fuperior petal larger than the reft; the germ is longer than the corolla; the legumen monofpermous. There is but one fpecies, the peruiferum, a native of Peru and the warmer parts of America. It is this fhrub that yields the balfam of Peru, which is faid to be extracted from it by coction in water. This balfam, as brought to us, is nearly of the confiftence of thin honey, of a reddifh brown colour, inclining to black, an agreeable aromatic fmell, and a very hot biting tafte. Diftilled with water, it yields a fmall quantity of a fragrant effential oil of a reddifh colour, and in a ftrong fire, without addition, a yellowifh red oil. Balfam of Peru is a very warm aromatic medicine, confiderably hotter and more acrid than copaiva. Its principal effects are to warm the habit, to ftrengthen the nervous fyftem, and attenuate vifcid humours. Hence its ufe in fome kinds of afthmas, gonorrhœas, dyfenteries, fuppreffions of the uterine difcharges, and other diforders proceeding from a debility of the folids or a fluggifhnefs and inactivity of the juices. It is alfo employed externally, for cleanfing and healing wounds and ulcers, and fometimes againft palfies and rheumatic pains.—There is another fort of balfam of Peru of a white colour,

Myrrh. colour, and considerably more fragrant than the former. This is very rarely brought to us. It is said to be the produce of the same plant which yields the common or black balsam, and to exsude from incisions made in the trunk, while the former is obtained by boiling. There is also a third kind, commonly called the red or dry. This is supposed to obtain a different state from the white, merely in consequence of the treatment to which it is subjected after it is got from the tree. It is almost as fragrant as the balsam of Gilead, held in so high esteem among the eastern nations. It is very rarely in use in Britain, and almost never to be met with in our shops.

MYRRH, a gummy-resinous concrete juice, obtained from an oriental tree of which we have as yet no certain account. It comes over to us in globes or drops, of various colours and magnitudes. The best sort is somewhat transparent, friable, in some degree unctuous to the touch, of an uniform brownish or reddish-yellow colour, often streaked internally with whitish semicircular or irregular veins; of a moderately strong, not disagreeable smell; and a lightly pungent, very bitter taste, accompanied with aromatic flavour, but not sufficient to prevent its being nauseous to the palate. There are sometimes found among it hard shining pieces, of a pale yellowish colour, resembling gum-arabic, of no taste or smell: sometimes masses of bdellium, darker coloured, more opaque, internally softer than the myrrh, and differing from it both in smell and taste: sometimes an unctuous gummy resin, of a moderately strong somewhat ungrateful smell, and a bitterish very durable taste, obviously different both from those of bdellium and myrrh: sometimes likewise, as Cartheuser observes, hard compact dark-coloured tears, less unctuous than myrrh, of an offensive smell, and a most ungrateful bitterness, so as, when kept for some time in the mouth, to provoke reaching, though so resinous, that little of them is dissolved by the saliva. Great care is therefore requisite in the choice of this drug.

We have, as already observed, no certain information concerning the tree from which this substance flows; we are only told that the myrrh-tree, or plant, is a native of Abexim in Ethiopia, and is named *bedoins* by the Arabs. It is affirmed by some, that the myrrh we have at present is not equal in quality to that of the ancients, and has not that exquisite smell which all authors ascribe to the latter. They aromatized their most delicious wines with it; and it was presented as a very valuable perfume to our Lord while he lay in the manger (A). But to this it may be easily answered, that there is no disputing about perfumes any more than about tastes and colours. Men are equally changeable with regard to smells, of which we have striking examples in musk and civet (B). The ancients reckoned two kinds of myrrh: the one liquid,

(A) It was this gum also which was mingled with the wine given him to drink at his passion, to deaden his pains, and produce a stupor. (See Mark xv. 23.) The gall mentioned on the same occasion by St Matthew is probably the same with myrrh; for any thing bitter was usually distinguished by the name of gall. The Hebrews were accustomed to give those that were executed some stupefying draught. The difficulty which arises from the seeming difference betwixt the two evangelists, by some is solved by saying, that St Matthew, writing in Syriac, made use of the word *marra*, which signifies "myrrh, bitterness, or gall;" but the Greek translator has taken it for gall, and St Mark for myrrh. Others will have it, that our Saviour's drink was mingled with myrrh, as a stupefying drug; but suppose that the soldiers, out of wanton cruelty and inhumanity, infused gall; which was the reason, say they, why, when he had tasted, he refused to drink.

(B) In the *Journal de Physique*, &c. *Suppl.* tom. xiii. 1778, we find some remarks on myrrh, made by Mr Bruce while in Abyssinia, of which the following is a statement: The same remarks have been since published in the Appendix to his Travels. The ancients, and particularly Dioscorides, who speak of myrrh, seem never to have seen it; or at least that which they have seen and described is altogether unknown to modern physicians and naturalists. The Arabians, however, who form the intermediate link in the chain between the Greek physicians and those of our days, among whom this substance grew, and from whom it received its name, afford an incontestable proof that the myrrh with which we are acquainted is in no respect different from that of the ancients, being produced in the same countries from which the Greeks formerly procured theirs; that is, on the eastern shores of Arabia Felix; on the coasts of the Indian ocean; and on that part of Lower Abyssinia which lies to the south-east of the Red-sea, nearly between the 12th and 13th degrees of north latitude, bounded on the west by a meridian running through the island of Massovia, and on the east by one which passes through Cape Guardsey in the straits of Babel-mandel. This region the Greeks called *Troglodytria*, and must be distinguished from the country of the Troglodites, a nation different in every respect, and inhabiting the forests between Abyssinia and Nubia. The Abyssinian myrrh was always more valued than that of Arabia; and this preference it still retains to the present day. That part of Abyssinia being partly overflowed with water, and partly desert and over-run by a barbarous nation from the south, the Arabians have very little intercourse with it except by means of some Mahometan merchants, whose desperate adventures, undertaken on chance, sometimes turn out well, but oftener prove very unfortunate. The island of Massova is the common medium of exportation for the Troglodite myrrh; but so little is brought from it in comparison with what is sent from Arabia to Grand Cairo, that this is certainly the only reason which can be assigned for the inferiority of our myrrh to that of the ancients, who received it from Abyssinia. Although these barbarians employ the gum, leaves, and bark of this tree in many diseases to which they are subject, as it is the most common tree in the country, they nevertheless cut it down and burn it for domestic purposes; and as they never plant new trees to replace those which they have cut down, it is probable that in a few years the

Myrrh.

quid, which they called *stacté* or *starti;* the other was solid, and went by the name of *troglodite myrrh.* The stacte was procured by incision, and was received in vessels very closely shut. Large pieces sometimes present externally, or contain a kind of oily juice to which likewise the moderns give the name of *Stacté.* To prevent this juice from hardening, or at least in a very small degree, it is sufficient to exclude it from the contact of the air immediately after its issuing from the tree; and by these means its aromatic nature will be much better preserved (c).

The medical effects of this aromatic bitter are to warm

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the true Troglodite myrrh will be entirely lost; and the erroneous descriptions of the ancient Greeks will lead posterity, as it has done us, to form many mistaken conjectures concerning the nature of the myrrh of the ancients.

Though the Troglodite myrrh was superior to every species of Arabian myrrh, the Greeks plainly perceived that it was not all of the same quality. Pliny and Theophrastus affirm, that this difference was owing to the trees, some of which were wild, and others meliorated by culture: but this is a mere conjecture; for the truth is that none of them are cultivated. The quality of the drug formerly depended, and must still depend, on the age and soundness of the tree, on the way of making the incision, and on the season of the year, and the temperature of the air when the myrrh is gathered. To have the first and most perfect kind of myrrh, the natives select a young vigorous tree, free from moss or any other plant adhering to the bark, and make a deep incision with a hatchet above the first large branches. What runs from this wound the first year, is myrrh of the first growth, and is never plentiful. This operation is performed some time after the rains have ceased, that is from April to June; and the myrrh is produced in July and August. At each return of the season, the sap continues to run in the course to which it has been accustomed; but the tropical rains, which are very violent, and which last for six months, convey so much filth and water into the incision, that by the second year the tree begins to rot at that place; so that the myrrh is of a secondary quality, and at Cairo does not bring so great a price by a third as the myrrh of the first year. That which issues from incisions near the roots and in the trunks of old trees is of the second growth and quality, and sometimes worse; but it is reckoned good myrrh in the shops of Italy every where except Venice. It is of a red-blackish colour, dirty, solid, and heavy. It loses very little of its weight by being long kept, and can scarcely be distinguished from that of Arabia Felix. The third and worst kind is that which flows from old incisions formerly made in old trees, or which not having been at first observed, has remained a whole year upon the tree. It is black, heavy, and of an earthy colour: it has little smell and bitterness, and is probably the *caucalis* of the ancients.

Myrrh newly gathered has always a strong smell of rancid oil; and when put into water, globules of an oily substance are detached from it, which rise and swim on the surface. This oiliness does not arise from the myrrh, but from being put by the natives into goats skins, which they anointed with butter to make them pliant. It is kept in these skins, and thus carried to market: so that instead of being a fault, as some suppose, it is a proof that the myrrh is newly gathered; which is the best property that myrrh of the first kind can have. Besides, this oily covering must have retained the volatile particles of the fresh myrrh, which escape in such abundance as frequently to occasion a considerable diminution in the weight.

(c) Pliny speaks of the starti as a recent or liquid myrrh: and Dioscorides, chap. 67. says nearly the same thing. Mr Bruce is of opinion (but we think he is mistaken), that the ancient Greeks and Romans, who lay at so great a distance, could never have it in that state; because he was assured by the natives, that it hardened on the tree as soon as it was exposed to the air; and because, though he was near the place where it grows, he never saw it softer than it is commonly found. Dioscorides mentions likewise a species of myrrh, which, he says, is green, and has the consistence of paste. Serapio and the Arabians affirm, that starti was a preparation of myrrh dissolved in water: hence Mr Bruce conjectures, that this green unknown species was likewise a composition of myrrh and some other ingredient; and by no means a kind of Abyssinian myrrh which they could never see either green or soft. The same author supposes, that *apocalbasum*, or gum of Sassa and myrrh, are one and the same substance; and he alleges, that Arabic myrrh may be distinguished from myrrh of Abyssinia in the following manner: A handful of the very small pieces which are found at the bottom of the packet containing the myrrh, is thrown into a bason with a sufficient quantity of warm water to cover them. Here the myrrh remains for some time without any perceptible change, because it dissolves slowly; whereas the gum swells to five times its original size, and appears like so many white particles among the myrrh. But nothing can be inferred from this distinction. Does the Arabian myrrh dissolve, and that of Abyssinia swell? In that case the Arabian myrrh would act like pure gum Arabic, or acacia gum, and that of Abyssinia like gum tragacanth. To us it appears, that Mr Bruce, of whose zeal and labours in other respects we entertain a high opinion, has not performed his experiments with sufficient care; or if there was no mistake in them, we must be allowed to think, that the supposed myrrhs which he employed were nothing but a mixture of Arabian gum acacia, and gum of Bassora, or Egyptian tragacanth. We are more inclined to be of this opinion, when he says that the branches, leaves, and bark of the myrrh tree were brought to him by naked savages from the country of the Troglodites; and that he found that the leaves and bark bore a great resemblance to the acacia vera. Among these leaves he observed some straight prickles, about two inches in length. He likewise mentions, that he saw a sassa tree which was a native of the myrrh country, and covered with beautiful crimson-coloured flowers. We know that the shrub which produces the gum tragacanth is prickly, and has flowers somewhat of a purple colour.

warm and ſtrengthen the viſcera: it frequently occaſions a mild diaphoreſis, and promotes the fluid ſecretions in general. Hence it proves ſerviceable in languid caſes, diſeaſes ariſing from a ſimple inactivity, thoſe female diſorders which proceed from a cold, mucous, ſluggiſh indiſpoſition of the humours, ſuppreſſions of the uterine diſcharges, cachectic diſorders, and where the lungs and thorax are oppreſſed by viſcid phlegm. Myrrh is likewiſe ſuppoſed in a peculiar manner to reſiſt putrefaction in all parts of the body; and in this light ſtands recommended in malignant, putrid, and peſtilential fevers, and in the ſmall-pox; in which laſt it is ſaid to accelerate the eruption.

The preſent practice does not ſeem to expect any peculiar virtue from myrrh; and it is now perhaps leſs employed than formerly. Some late writers, however, and particularly Dr Simmons, in his treatiſe on Conſumptions, have beſtowed very high encomiums on it, even in caſes of tuberculous phthiſis; and although it can by no means be repreſented as a remedy much to be depended on, yet there is reaſon to believe that it has been ſerviceable in ſome caſes.

Rectified ſpirit extracts the fine aromatic flavour and bitterneſs of this drug, and does not elevate any thing of either in evaporation: the gummy ſubſtance left by this menſtruum has a diſagreeable taſte, with ſcarcely any of the peculiar flavour of the myrrh: this part diſſolves in water, except ſome impurities which remain. In diſtillation with water, a conſiderable quantity of a ponderous eſſential oil ariſes, reſembling in flavour the original drug. Myrrh is the baſis of an officinal tincture. It enters the pilulæ ex aloe et myrrha, the pilulæ e gummi, and pilulæ ſtomachicæ, and ſome other formulæ. But for obtaining its full effects, it muſt be given in doſes of half a dram or upwards: and it is thought to be advantageouſly united with a proportion of nitre, cream of tartar, or ſome other refrigerant ſalt.

MYRRHINE, or Murrine. See Murrine.

MYRSINE, in botany: A genus of the monogynia order, belonging to the pentandria claſs of plants; and in the natural method ranking under the 18th order, *Bicornes*. The corolla is ſemiquinquefid and connivent; the germen filling the corolla; the berry quinquelocular and pentaſpermous.

MYRTIFORM, in anatomy, an appellation given to ſeveral parts, from their reſembling myrtle-berries.

MYRTIS, a Greek woman who diſtinguiſhed herſelf by her poetical talents. She flouriſhed about 500 years before the Chriſtian era, and inſtructed the celebrated Corinna in the ſeveral rules of verſification. Pindar himſelf, as ſome report, was alſo one of her pupils.

MYRTLE, in botany. See Myrtus.

MYRTOUM mare, a part of the Ægean ſea, lying between Eubœa, Peloponneſus, and Attica. It receives this name from Myrto a woman, or from Myrtos a ſmall iſland in the neighbourhood, or from Myrtilus the ſon of Mercury who was drowned there, &c.

MYRTUS (anc. geog.), a ſmall iſland near Caryſtus in Eubœa, which gave name to the Mare Myrtoum. Others, according to Pauſanias, derive the appellation from *Myrto*, the name of a woman. Strabo extends this ſea between Crete, Argia, and Attica. Pauſanias beginning it at Eubœa, joins it at Helena, a deſart iſland, with the Ægean ſea. Ptolemy carries it to the coaſt of Caria. Pliny ſays, that the Cyclades and Sporades are bounded on the weſt by the Myrtoan coaſt of Attica.

Myrtus, in botany, the *Myrtle:* A genus of the monogynia order, belonging to the icoſandria claſs of plants; and in the natural method ranking under the 19th order, *Heſperideæ*. The calyx is quinquefid, ſuperior; there are five petals; the berry is diſpermous or triſpermous. There are 14 ſpecies, of which the moſt remarkable are,

1. The communis, or common myrtle-tree, riſes with a ſhrubby, upright, firm ſtem, branching numerouſly all around into a cloſe full head, riſing eight or ten feet high; very cloſely garniſhed with oval-lanceolate, entire, moſtly oppoſite leaves, from half an inch to an inch and a half long, and one broad, on ſhort footſtalks; and numerous, ſmall, pale flowers from the axillas, ſingly on each footſtalk, having diphyllous involucrums; each flower ſucceeded by a ſmall, oval, dark-purple berry. The moſt material varieties are, broad-leaved Roman myrtle, with oval, ſhining, green leaves, an inch and an half long, and one broad; and which is remarkably floriferous. Gold-ſtriped broad-leaved Roman myrtle. Broad leaved Dutch myrtle, with ſpear-ſhaped, ſharp pointed, dark-green leaves, an inch long, and about three quarters of one broad. Double-flowered Dutch myrtle. Broad-leaved Jews myrtle, having the leaves placed by threes at each joint; by which particular circumſtance this ſpecies is in univerſal eſtimation among the Jews in their religious ceremonies, particularly in decorating their tabernacles; and for which purpoſe many gardeners about London cultivate this variety with particular care, to ſell to the above people, who are often obliged to purchaſe it at the rate of ſixpence or a ſhilling for a ſmall branch: for the true ſort, having the leaves exactly by threes, is very ſcarce, and is a curioſity; but by care in its propagation, taking only the perfectly ternate-leaved ſhoots for cuttings, it may be increaſed faſt enough; and is worth the attention of the curious, and particularly thoſe who raiſe myrtles for the London markets. Orange-leaved Spaniſh myrtle, with oval ſpear-ſhaped leaves, an inch and a half long or more, and one broad, in cluſters round the branches, and reſemble the ſhape and colour of orange-tree leaves. Gold-ſtriped leaved orange myrtle. Common upright Italian myrtle, with its branches and leaves growing more erect, the leaves oval, lanceolate-ſhaped, acute-pointed, and near an inch long and a half one broad. Silver-ſtriped upright Italian myrtle. White-berried upright Italian myrtle. Portugal acute-leaved myrtle, with ſpear-ſhaped, oval, acute-pointed leaves, about an inch long. Box-leaved myrtle, with weak branches, ſmall, oval, obtuſe, lucid-green, cloſely-placed leaves. Striped box-leaved myrtle. Roſemary-leaved myrtle, hath erect branches, ſmall, narrow, lanceolate, acute-pointed, ſhining, green, very fragrant leaves. Silver-ſtriped roſemary-leaved myrtle. Thyme-leaved myrtle, with very ſmall cloſely-placed leaves. Nutmeg-myrtle, with erect branches and leaves; the leaves oval, acute-pointed, and finely ſcented like a nutmeg. Broad-leaved nutmeg-myrtle. Silver-ſtriped leaved ditto. Criſtated or cock's-comb myrtle, frequently called *bird's-neſt myrtle*,

Myrtus. *myrtle*, hath narrow, ſharp-pointed leaves, criſtated at intervals. Theſe are all beautiful ever-green ſhrubs of exceeding fragrance; exotics originally of the ſouthern parts of Europe, and of Aſia and Africa, and conſequently in this country require ſhelter of a green houſe in winter: all of which, though rather of the ſmall-leaved kind, have their foliage cloſely placed, and remain all the year, and are very floriferous in ſummer; and when there is a collection of the different ſorts, they afford an agreeable ſource of variety with each other. They therefore claim univerſal eſteem as principal green houſe plants, eſpecially as they are all ſo eaſily raiſed from cuttings, and of ſuch eaſy culture, as to be attainable in every garden where there is any ſort of green-houſe, or garden-frames furniſhed with glaſſes for protecting them in winter from froſt: but ſome of the broad-leaved ſorts are ſo hardy as to ſucceed in the full ground, againſt a ſouth wall and other warm expoſures, all the year, by only allowing them ſhelter of mats occaſionally in ſevere froſty weather: ſo that a few of theſe ſorts may alſo be exhibited in a warm ſituation in the ſhrubbery: obſerving, however, all the ſorts are principally to be conſidered as green-houſe plants, and a due portion of them muſt always remain in pots to move to that department in winter.

Plate CCCXXXVI 2. The pimenta, pimento, Jamaica pepper, or all ſpice tree, grows above 30 feet in height and two in circumference; the branches near the top are much divided and thickly beſet with leaves, which by their continual verdure always gives the tree a beautiful appearance; the bark is very ſmooth externally, and of a grey colour; the leaves vary in ſhape and in ſize, but are commonly about four inches long, veined, pointed, elliptical, and of a deep ſhining green colour; the flowers are produced in bunches or panicles, and ſtand upon ſubdividing or trichotomous ſtalks, which uſually terminate the branches; the calyx is cut into four roundiſh ſegments; the petals are alſo four, white, ſmall, reflex, oval, and placed oppoſite to each other between the ſegments of the calyx; the filaments are numerous, longer than the petals, ſpreading, of a greeniſh white colour, and riſe from the calyx and upper part of the germen; the antheræ are roundiſh, and of a pale yellow colour; the ſtyle is ſmooth, ſimple, and erect; the ſtigma is obtuſe; the germen becomes a round ſucculent berry, containing two kidney-ſhaped flattiſh ſeeds. This tree is a native of New Spain and the Weſt India iſlands. In Jamaica it grows very plentifully; and in June, July, and Auguſt, puts forth its flowers, which, with every part of the tree, breathes an aromatic fragrance. The berries when ripe are of a dark purple colour, and full of a ſweet pulp, which the birds devour greedily, and muting the ſeeds, afterwards propagate theſe trees in all parts of the woods. It is thought that the ſeeds paſſing through them, in this manner, undergo ſome fermentation, which fits them better for vegetating than thoſe gathered immediately from the tree.

The pimento is a moſt beautiful odoriferous evergreen, and exhibits a fine variety in the ſtove at all ſeaſons. It was firſt introduced and cultivated in this country by Mr Philip Miller in 1739. With reſpect to flowering, all the varieties of the *myrtus communis* flower here in July and Auguſt, moſt of which are very floriferous; the broad-leaved Roman kind in particular is often covered with flowers, which in ſome of the ſorts are ſucceeded here by berries ripening in winter. The pimento alſo flowers in the ſtove with great beauty and luxuriance. The flowers of moſt of the ſorts are ſmall, but numerous; and are all formed each of five oval petals and many ſtamina. As all theſe plants require protection in this country, they muſt be kept always in pots, for moving to the proper places of ſhelter, according to their nature; the *myrtus communis* and varieties to the green-houſe in winter, the pimento and other delicate kinds to the ſtove, to remain all the year: therefore let all the ſorts be potted in light rich earth; and as they advance in growth, ſhift them into larger pots, managing the myrtles as other green-houſe ſhrubs, and the ſtove-kinds as other woody exotics of the ſtove. Myrtus.

Properties, &c. The leaves and flowers of *common* upright myrtle have an aſtringent quality, and are uſed for cleanſing the ſkin, fixing the teeth when looſened by the ſcurvy, and ſtrengthening the fibres. From the flowers and young tops is drawn a diſtilled water that is deterſive, aſtringent, coſmetic, and uſed in gargles. A decoction of the flowers and leaves is applied in fomentations. The berries have a binding deterſive quality; and the chemical oil obtained from them is excellent for the hair, and uſed in pomatums and moſt other external beautifiers of the face and ſkin. As an internal medicine, theſe berries have little or merit.

In the *Dictionnaire portatif d'Hiſtoire Naturelle*, a fact is related, which, if true, tends to ſhow the ſtrongly aſtringent quality of myrtle. "Myrtle (ſays he) is likewiſe the baſe of a pommade called *pommade de la Comteſſe*, and well known on account of an extraordinary hiſtorical fact. One of thoſe gay youths who flutter about the toilets of the fair, happened one day to be left alone in the ſtorehouſe of the graces. With eager curioſity he examined the perfumes, the ſmelling bottles, the perfumed powder, the eſſences, and the coſmetics. To give more of the vermilion and greater pliancy to his lips, and to remove ſome diſagreeable eruptions, he lightly ſpreads with his indiſcreet finger the fatal pommade, looks at himſelf in the glaſs, and contemplates his beauty with admiration. The lady enters; he wiſhes to ſpeak, but his lips contracted, and he could only ſtammer. The lady looked at him with aſtoniſhment; at length caſting her eyes on the toilet, ſhe diſcovered by the open pot the cauſe of the miſtake, and enjoyed a hearty laugh at the expence of her admirer, whoſe confuſion announced his indiſcretion."

Pimento berries are chiefly imported into Britain from Jamaica; whence the name *Jamaica pepper*. It is alſo called *all-ſpice*, from its taſte and flavour being ſuppoſed to reſemble thoſe of many different ſpices mixed together. It is one of the ſtaple articles of Jamaica; where the pimento walks are upon a large ſcale, ſome of them covering ſeveral acres of ground. When the berries arrive at their full growth, but before they begin to ripen, they are picked from the branches, and expoſed to the ſun for ſeveral days, till they are ſufficiently dried; this operation is to be conducted with great care, obſerving that on the firſt and ſecond day's expoſure

exposure they require to be turned very often, and always to be preserved from rain and the evening dews. After this process is completed, which is known by the colour and rattling of the seeds in the berries, they are put up in bags or hogsheads for the market. This spice, which was at first brought over for dietetic uses, has been long employed in the shops as a succedaneum to the more costly oriental aromatics: it is moderately warm, of an agreeable flavour, somewhat resembling that of a mixture of cloves, cinnamon, and nutmegs. Distilled with water it yields an elegant essential oil, so ponderous as to sink in the water, in taste moderately pungent, in smell and flavour approaching to oil of cloves, or rather a mixture of cloves and nutmegs. To rectified spirit it imparts, by maceration or digestion, the whole of its virtue: in distillation it gives over very little to this menstruum, nearly all its active matter remaining concentrated in the inspissated extract. Pimento can scarcely be considered as a medicine: it is, however, an agreeable aromatic, and on this account is not unfrequently employed with different drugs, requiring such a grateful adjunct. Both the pharmacopœias direct an aqueous and spirituous distillation to be made from these berries, and the Edinburgh college order also the *oleum essentiale piperis Jamaicensis*.

MYSIA, a country of Asia Minor, generally divided into Major and Minor. Mysia Minor was bounded on the north and west by the Propontis and Bithynia, and Phrygia on the southern and eastern borders. Mysia Major had Æolia on the south, Ægean on the west, and Phrygia on the north and east. Its chief cities were Cyzicum, Lampsacus, &c. The inhabitants were once very warlike; but they greatly degenerated, and the words *Mysorum ultimus* was emphatically used to signify a person of no merit. The ancients generally hired them to attend their funerals as mourners, because they were naturally melancholy and inclined to shed tears. They were once governed by monarchs. They are supposed to be descended from the Mysians of Europe, a nation who inhabited that part of Thrace which was situated between Mount Hæmus and the Danube.

MYSON, a native of Sparta, one of the seven wise men of Greece. When Anacharsis consulted the oracle of Apollo, to know which was the wisest man in Greece, he received for answer, he who is now ploughing his fields. This was Myson.

MYSORE, or MYSOREAN DOMINIONS, a kingdom of Asia, in the East Indies, consisting of the following territories usurped or subdued by the late Hyder Ali, and transmitted to his son Tippoo Saib the present sultan.

1. Mysore Proper, or Seringapatam (from its capital), forming the independent state of a Hindoo rajah for near 200 years from its dismemberment, as a province of the Bejenagur empire, fell into the hands of Hyder Ali Khan about the year 1763, by cutting off the Dalaway, or regent usurper of the government, and seizing the reins of administration himself; but without leaving even the shadow of any authority to a nominal rajah of his own creation, excepting in the formularies of justice or finance, and preserving on one side of the pagoda coin the impression of two swamies or divinities of the Hindoos, while the other was made to bear the initial letter of his proper name Hyder. The whole country, now again reduced into the form of a province dependent on the new Mysorean dominion of a mussulman in the person of Tippoo, is bounded on the west by the Balagaut hills of Koork, and those called Anemally, bordering the whole coast of Malabar; on the east it frontiers with the Carnatic Payengaut and its dependencies along the Coromandel coast; and, on the north, with the pergunnahs of Serah, Bangalore, and Colar, belonging to the Carnatic-Balagaut-Bejapoury, in a longitudinal line little short of 200 English miles. From this latter boundary, in a form nearly triangular, it stretches 240 miles towards the south, where it terminates in a point at the extremity of Dindigul, near the pass of Goodalore, through the Anemally hills, on the confines of Travancore, and within 100 miles of Cape Comorin. It partakes of the two great divisions of country known in the Decan by the terms Balagaut and Payengaut, or upper and lower region. The former, comprehending the districts immediately dependent on the capital, and 43 subordinate forts, chiefly on eminences, is but indifferently watered by the several branches of the Caveri, at no great distance from its source; and must therefore, as well as in consequence of an elevated situation, precluded from foreign commerce, with scarcely any internal industry, be comparatively poor, as it is productive only of the smaller grains of joary and bajary, or a species of Indian corn, with the different kinds of vetches common to India; from all which, however, a nett revenue, in money or kind, of seven lacks of hoons or pagodas, being about 27 lacks of rupees, is computed to be forthcoming to the state, after defraying the ordinary charges of collection, which here, as in the rest of Hindostan, consist chiefly of an establishment of village peons or militia, reckoned 40,000 in number, for the whole province of Mysore, supposed to contain 15,400 square geographic miles. The latter, or Payengaut division, making scarcely a third part of this extensive area, is better known to us under the name of Coimbatore, including the districts of Caroor, Darampour, and Namcul, on both sides of the Caveri, with the valley of Dindigul on the south, and the great pass of Palligautcherry towards Malabar on the west: it is extremely fertile and well cultivated; therefore, in proportion to its extent, more productive of revenue than the Balagaut territory, being estimated nett at 19 lacks of rupees. The rajahs of Koork, and other Pallygars among the Gauts, from Bidenore south to Dindigul, occupy independently a considerable tract of country within the general description of Tippoo's dominions: but which being inaccessible to regular troops by hills or impervious woods, the Mysorean power hath never been able to conquer, further than to facilitate the catching of a few elephants yearly, by means of the natives.

2. Bedenore, or Ikeri, now Hydernagur, on the dissolution of the Canarine empire, of which it was a part, became an independent state under its Naicks of the race of Vencataputty, after which it fell under the divided female government of different rannies or queens, and so continued until conquered wholly by Hyder between the years 1763-5. This country is also divided into alagaut and Payengaut; the latter stretching

Myfore. ftretching 140 miles along the fea-coaft from Declah, or the river Cangrecora, being the northern frontier of Malabar, north to Honawar or Onore, on the confines of Soonda, in different breadths of plain territory, from 40 to 50 miles, but which may in all form an area of 3200 fquare miles, ftill retaining the ancient name of Canara, and including the ports of Mangalore, Barcelore, Onore, &c. The former or elevated divifion beyond the Supramanny Gauts, and immediately dependent on the capital Bedenore, Hanampour, &c. is of great indefinite extent inland, on both fides of the Tumbhudra; perhaps twice more confiderable in fize, though not proportionably fo in value, to the maritime border. Both divifions, however, allowing for a revenue eftablifhment of about 22,000 village peons, are affeffed for feven lacks of Ikeri pagodas, which, at four rupees each, make a clear income to the exchequer of 28 lacks of rupees.

3. Soonda, in circumftances of hiftory or final conqueft, might be placed under the preceding head; as alfo from a fimilarity in its geographical defcription, with only the difference of being on a much fmaller fcale. The Payengaut, from the diftrict of Onore to the frontiers of Goa, along a fea-coaft of 60 miles, cannot comprehend above 1100 fquare miles of territory, in which the port of Carwar may be confidered the capital; while a much larger extent muft be allowed for that portion of the diftrict beyond the Gauts to the eaftward. The whole revenue, however, of both divifions, does not exceed two lacks of pagodas, or eight lacks of rupees.

4. Malabar. The country under this defcription, and conquered by Hyder in 1765-6, exclufive of Koork, is altogether Payengaut; ftretching along the fhore from Declah fouth to Cochin about 200 miles, and comprehending, in an area of perhaps 6000 fquare miles, the Samery's territory of Calicut, with the petty ftates of Cartinad, Cotiotie, Cherica, or Canore, on the north, and the tributary kingdom of Cochin on the fouth;—the whole rated at a revenue of five lacks of pagodas, or about 19 lacks of rupees, after allowing for the maintenance of 18,000 village peons.

5. Barah Mhal, or twelve pergunnahs, was one of the earlieft conquered annexations of Hyder to the Myforean dominion, though in the war of 1768 it was over-run and for a while in poffeffion of the company's troops. The whole circar or diftrict of Jugdeo, compofed of heights and valleys on the confines of the Balagaut and Payengaut Carnatics, being one of the feven dependencies of Ginjee fubjected to the Mogul in 1698, was then fubdivided into 17 pergunnahs, and affeffed for a grofs revenue of 1,757,717 rupees. Of thefe fubdivifions, Amboor, Sautgur, &c. remain to the Payengaut: the reft in the hands of Tippoo, may comprehend, exclufive of the poligarry of Shili Naick, about 1800 fquare miles; but the nett revenue of the fame territory, after defraying the ordinary expences of collection, does not exceed five lacks of rupees at prefent.

Thefe five provinces of the Myforean empire, with the diftricts of Bangalore, Colar, &c. of the Carnatic-Balagaut Bejapoory, formed the whole of Hyder's dominion in the war 1768; and were calculated then to yield in all a nett income of 119 lacks and an half of rupees, allowing an eftablifhment of 115,000 village peons to enforce the collections, and maintain internal peace

6. Petty ftates of Hindoo rajahs, fituated on the weft and north of the Hendery and Tumbhudra rivers, to the confines of Goa, and the Merhatta territories of Toorgul, Raibaug, and Meritch, forming the jageer of Perferam Bow beyond the fouthern branch of the Kiftnah. Some of thefe rajahfhips had been entirely conquered by the Mogul; but the moft confiderable of them never were fubdued by any Muffulman power until Hyder's conqueft of them between the years 1774-7, though different diftricts from each may have been difmembered for a while by the Mogul deputies of the Carnatic-Balagaut Bejapoory, and therefore annexed in the accounts of the revenue of that circar. The frontier forts, and dependencies, of Goojunder-gur, Darwar, Badamy, &c. near the fouthern branch of the Kiftnah towards the Merhattah dominion, compofed at one time the jageer of Ragenaut Row, and have frequently changed their mafters. They fell ultimately to Tippoo at the peace of 1784, but he was forced to pay chout for them to the Pefhwa. On the whole, all thefe ftates, of great indefinite extent and extremely poor, yield only a precarious revenue of 16 lacks of rupees to the Myforean.

7. Carnatic Balagaut Bejapoory, confifting, under the Mogul, of one circar of the fame name, and of which the capital was Serah. It comprehended 51 pergunnahs, of which Bangalore, Colar, &c. on the fouth, were feized by Hyder, immediately when he poffeffed himfelf of Myfore; but Anantpour, Penekonda, &c. on the north, with the reft of the Merhattah ftate of Gooty, did not fall into his hands until the year 1776, when he overcame and made prifoner the proprietor Morarow, who had rendered fignal fervice to the Englifh in the preceding Myforean war. The whole circar was rated at a jumma *kaumil*, or total grofs revenue on the king's books, of 4391 6,396 rupees: but the accuracy of this valuation is much to be doubted; becaufe it does not appear from the regifters of the foubah of Bejapour that the Mogul government ever afcertained the *dehatee* or village collections of either of the Carnatics, or went into greater detail than to fix the ftandard affeffment of the different pergunnahs; and becaufe the amount thus ftated feems too large a receipt from a country naturally fo poor and deftitute of commerce, probably in all its dimenfions not exceeding 10,000 fquare miles, and which was fo liable to internal difturbances or foreign invafion, that notwithftanding the number of ftrong holds to be found in it, every town required and has its own particular fortification. However this may be, the revenue actually forthcoming to Hyder in 1778, after defraying charges of collection and an eftablifhment of about 30,000 village peons, was only 3,205,206 rupees.

8. Carnatic-Balagaut-Hydrabady, comprehending the five circars of Sidhout, Kahmam, Ganjecottah, Gooty, and Gorrumkonda, which were fubdivided into 66 pergunnahs, rated by the Moguls kaumils 4,707,306 rupees: but from this amount is to be deducted the aggregate valuation of the pergunnahs or Chittoor, &c. now annexed to the Payengaut, together with the affeffment of the diamond-mines of Ganjecottah,

Myfore.

jecottah, which are no longer productive, making in all an object of two lacks of rupees. The whole country thus defcribed, bounded by the circars of Adoni and Nundial on the north towards the Kiftnah, the Guntour circar and Carnatic Payengaut on the eaft, with that of the Balagaut Bejapoury on the fouth and weft, may in fquare dimenfions be nearly equal to this laft mentioned divifion of territory of about 10,000 fquare miles. It formed the inheritance for four generations of the Patan nabobs of Cuddapah, defcended from a collateral branch of the Sanore family, until Gooty and Gorrumkonda were taken by the Merhattahs in 1758, and then ultimately, with the remainder of Helim Khan's poffeffion, by Hyder in 1776-9. After deducting the amount of a few jageers and fome charitable lands ftill left to the Mahomedans of this diftrict, with the expence of an eftablifhment at leaft of 23,000 village peons, the nett revenue of the whole province may be eftimated at 29 lacks of rupees.

9. Adoni, or circar of Imtiazghur on both fides of the Hendery river, fouth of the Tumbhudra or Tungabudra river, as far as and inclufive of Bellary, together with a fmall portion of the circar of Ghazipour or Nundial, difmembered from the nabobfhip of Karnool, all fituated in the foubah of Bejapour, comprehend the whole of Tippoo's conquefts and annexation to the Myforean empire, acquired fince the death of Hyder, and fubfequently to the treaty of Mangalore in 1784. In extent and revenue, this acquifition may be confidered of little account. The former cannot exceed 5000 fquare miles, and the latter fcarcely feven lacks of rupees, reckoning the petty zemindary of Bellary. But the fort of Adoni is of confiderable importance, as being of the kind (on an infulated rock) thought the ftrongeft in Hindoftan, without excepting Dowlatabad or Gualior. It was ever the favourite ambitious object of conqueft to Hyder, the Merhattas and Nizam; and preferved only through the cautious policy of its proprietor, Baffalut Jung. When it came by inheritance into the weak inexperienced hands of his fon Mohabet Jung, it fell by treachery under the dominion of Tippoo; together with all its territorial dependencies, except the circar of Raichore, between the Kiftnah and Tumbhudra.

The extent of Tippoo's dominion, according to the lateft maps, has been computed at 80,000 fquare geographic miles, or 92,666 Englifh. Thus confidering it a triangle, of which the bafe runs nearly parallel to and not far fouth of the Kiftnah, in a longitudinal line of 340 Englifh miles, about the 16th degree of north latitude, or from the pagoda of Tripanti in the north-eaft angle to Kittoor in the north-weft, towards the frontiers of Goa, of Bari, and the Merhattahs; then, one of its fides, along the Balagaut or mountainous ridge of the Malabar coaft, will be found to ftretch in a horizontal diftance 500 miles foutherly, to the extreme point and pafs of Goodalore in that quarter; and its other fide from thence northerly, touching the frontiers of the Carnatic Payengaut, 470 miles in a parallel direction to the Coromandel coaft, until it reaches the further corner of the circar of Kahmam near the firft mentioned point at the pagoda of Tripanti. Beyond thefe three lines, the plains bordering the fhores of Canara and Malabar are the only exclufive territory of confiderable extent belonging to Tippoo; and to balance it in fome degree, within the area of the triangle defcribed, it is to be remembered are fituated the independent or environed ftates of Sanore, Koork, &c. if not alfo a part of Karnool and Raichore. As the whole face of the country is known to be rugged, in many parts defolate, badly watered, and generally rifing abruptly near half a mile of perpendicular height above the level of the fea, it cannot be fuppofed that the foil is equally fertile with the lower lands of Hindoftan. In fact, though every advantage of induftry and population be allowed to a defpotic government, which cherifhes a numerous peafantry in exclufion of great intermediate landholders, yet the produce of the Balagaut altogether confifts merely of the neceffaries of life, and thefe of the coarfeft kind; juft enough to fubfift the inhabitants, after making fufficient provifion in pafture for the extraordinary number of horfes and other cattle maintained there for the military eftablifhment: while, in the Payengaut on the Malabar coaft, fome pepper, cardamums, fandal wood, and furplus grain beyond internal confumption, conftitute the only commercial funds of natural growth within the whole circle of the Myforean dominion. As to manufactures, except thofe of Salem and Bellary, if any exift in the country, they are not confiderable enough to be known abroad.

From the foregoing view of the nature, produce, and revenues of the Myforean empire, it may be concluded that we could have no lucrative profpects in our late contefts with Tippoo Sultan; but were compelled, for the prefervation of our own poffeffions in that quarter, to undertake his reduction as a reftlefs, cruel, ambitious, and depredatory neighbour. This has accordingly been effected by the good conduct of Lord Cornwallis; who, in the iffue of the war, has obliged him to cede half his dominions to the Company and its allies, adjacent to their refpective boundaries, and fubject to their felection.

MYSTERIES.

1 The gradual introduction of myfteries into religion.

RELIGION, in its original form, was fimple and intelligible. It was intended for the inftruction and edification of all ranks of men; and of confequence its doctrines were on a level with vulgar capacities. The Jewifh difpenfation was openly practifed: nothing was performed in fecret; every article was plain, open, and acceffible. The divine Author of the Chriftian œconomy commanded his difciples to preach his doctrine in the moft public manner: "What ye have heard in fecret (fays he) preach openly; and what I have taught you in private teach ye publicly, and proclaim it on the houfe-tops." Such are the charms of truth, and fuch the character of that religion which came down from heaven, that they, as it were,

were, "delight in the light, and lift up their voice in the ſtreets, and cry in the chief places of concourſe."

But ſuch is the depravity of the nature of man, that the nobleſt inſtitutions degenerate in his hands. Religion itſelf, originally pure, ſimple, and amiable, under his management has often been transformed into pollution, perplexity, and deformity. The miniſters of religion, whoſe province it was to guard the ſacred depoſit, and to ſecure it from foreign and ſpurious intermixtures, have generally been the firſt innovators, and the firſt and moſt induſtrious agents in corrupting its integrity and tarniſhing its beauty. Avarice and ambition prompted that claſs of men to deviate from the original plainneſs and ſimplicity of religious inſtitutions, and to introduce articles, rites, and uſages, which might furniſh them with opportunities of gratifying theſe unhallowed and inſatiable paſſions. Hence diſtinctions unknown to pure and undefiled religion were fabricated, and that heavenly inſtitution, heretofore one, ſimple, indiviſible, was divided into two partitions: the one popular and public; the other dark, ſecret, and myſterious. The latter of theſe we intend as the ſubject of this article.

2 Etymology and import of the term.

The Engliſh word *myſtery* is derived from the Greek μυστηριον; and in its modern acceptation imports ſomething above human intelligence, ſomething awfully obſcure and enigmatical; any thing artfully made difficult; the ſecret of any buſineſs or profeſſion. The word is often uſed by the founder of the Chriſtian religion, and more frequently by his apoſtles, eſpecially St Paul. In theſe caſes, it generally ſignifies thoſe doctrines of Chriſtianity which the Jews, prior to the advent of the Meſſiah, either did not or could not underſtand. The Trinity in Unity, and the Unity in Trinity; the incarnation of the Son of God; the union of two natures in one and the ſame perſon, &c. we generally call *myſteries*, becauſe they are infinitely above human comprehenſion All theſe ſignifications are out of the queſtion at preſent

3 Object of this article.

Our intention in this article is to lay before our readers the fulleſt and faireſt account we have been able to collect, of thoſe αποῤῥητα, or *ſecret rites*, of the pagan ſuperſtition, which were carefully concealed from the knowledge of the vulgar, and which are univerſally known under the denomination of *myſteries*.

The word Μυστηριον is evidently deduced from Μυστης; but the origin of this laſt term is not altogether ſo obvious. The etymologies of it exhibited by the learned are various; ſome of them abſurd and inconſiſtent, others fooliſh and futile. Inſtead of fatiguing our readers with a detail of theſe, which would be equally unintertaining and unintereſting, we ſhall only produce one, which to us appears to come neareſt the truth. The myſteries under conſideration at preſentwere certainly imported into Greece from the Eaſt. In thoſe regions, then, we ought of courſe to look for the etymology of the word. *Miſtor*, or *miſtur*, in Hebrew, ſignifies "any place or thing hidden or concealed." As this word implies a kind of definition of the nature of the thing intended, and as it is one of the excellencies of original languages to apply vocables with this propriety, we find ourſelves ſtrongly inclined to aſſign the word *miſtur* as the root of the term Μυστης, *myſter*.

4 Motives to the introduction of the myſteries.

We have already obſerved, that the avarice and ambition of the pagan prieſthood probably gave birth to the inſtitution of the myſteries. To this obſervation we may now add, that the miniſters of that ſuperſtition might poſſibly imagine, that ſome articles of their ritual were too profound to be comprehended by the vulgar: others, too ſacred to be be communicated to a deſcription of men whom the inſtitutions of civil ſociety had placed in a ſituation not only ſubordinate but even contemptible. It was imagined, that things ſacred and venerable would have contracted a taint and pollution by an intercourſe with ſordid and untutored ſouls. Theſe appear to us the moſt probable motives for making that odious and pernicious diſtinction between the popular religion and that contained in the ſacred and myſterious ritual.

5 The hypotheſis of Warburton ill founded.

The learned Biſhop Warburton is poſitive, that the myſteries of the Pagan religion were the invention of legiſlators † and other great perſonages, whom fortune or their own merit had placed at the head of thoſe civil ſocieties which were formed in the earlieſt ages in different parts of the world. It is with reluctance, and indeed with diffidence, that we preſume to differ in our ſentiments from ſuch reſpectable authority. Whatever hypotheſis this prelate had once adopted, ſo extenſive was his reading, and ſo exuberant his intellectual reſources, that he found little difficulty in defending it by an appearance of plauſibility, if not of rational argumentation. The large quotations he has adduced from Plato and Cicero, do indeed prove that the ſages and legiſlators of antiquity ſometimes availed themſelves of the influence derived from the doctrines of the myſteries, and from the authority they acquired by the opinion of their having been initiated in them; but that thoſe men were the inventors and fabricators of them, is a poſition for which his quotation do not furniſh the moſt ſlender preſumption. At the ſame time, we think it not altogether certain, that the doctrine of a divine Providence, and a future ſtate of rewards and puniſhments, were revealed in the myſteries with all the clearneſs and cogency which is pretended by his Lordſhip.

† *Divine Leg.*

But granting that the fabric was raiſed by the hands of ſages and legiſlators, we imagine it would be rather difficult to diſcover what emolument that deſcription of men could propoſe to derive from the enterpriſe.—The inſtitution was evidently, and indeed confeſſedly, deviſed to conceal from the million thoſe very doctrines and maxims, which, had they known and embraced them, would have contributed moſt effectually to diſpoſe them to ſubmit to thoſe wiſe regulations which their governors and legiſlators wiſhed moſt ardently to eſtabliſh. Experience has taught, that nothing has a more commanding influence on the minds of the vulgar, than thoſe very dogmas, which, according to the Biſhop, were communicated to the initiated. A conviction of the Unity of the Deity, of his wiſdom, power, goodneſs, omnipreſence, &c. the ſteady belief of the immortality of the human ſoul, and of a future ſtate of rewards and puniſhments, have in all ages, and in all countries, proved the firmeſt ſupports of legal authority. The very ſame doctrines, in the dawn of Chriſtianity, contributed of all other methods the moſt effectually to tame and civilize the

ſavage

savage (A) inhabitants of the northern regions of Europe. Supposing those principles to have been inculcated by the mysteries, the most prudent plan legislators could have adopted, would have been to publish them to all mankind. They ought to have sent forth apostles to preach them to the savages whom they had undertaken to civilize. According to the learned prelate, they pursued the opposite course, and deprived themselves of those very arms by which they might have encountered and overthrown all the armies of savagism.

6 Mysteries of Eleusis said to be revealed publicly in Crete. * Lib. 5.

Of all the legislators of antiquity, the Cretan alone was prudent enough to see and adopt this rational plan. Diodorus the Sicilian informs us*, that the mysteries of Eleusis, Samothracia, &c. which were elsewhere buried in profound darkness, were among the Cretans taught publicly, and communicated to all the world. Minos, however, was a successful legislator; and his intercourse with Jupiter Idæus extended his influence and established his authority. He was not under the necessity of calling in the mysteries to his assistance: on the contrary, it is highly probable that the universal knowledge of the doctrines of the mysteries among his countrymen contributed in a considerable degree to facilitate his labour, and ensure his success.

The divine Author of the Christian œconomy, viewed in the light of a human legislator, saw the propriety of this procedure. Nothing was concealed in his institutions; nothing was veiled with mystery, or buried in darkness. The success was answerable to the wisdom of the plan. The million flocked to the evangelical standard: the gospel was preached to the poor, to the illiterate and the vulgar; and the meanest of mankind eagerly embraced its maxims. Wherever it prevailed, it produced civilization, morality, sobriety, loyalty, and every other private and social virtue.—Upon the supposition that the mysteries had contained and inculcated the principles and practices which the prelate supposes they did, the civilizers of mankind, legislators, magistrates, and princes, ought to have combined to make them public for the sake of their own tranquillity, and the more effectual support of their authority and influence.

7 Mysteries the offspring of Egyptian priestcraft; but

Upon the whole, we are inclined to believe that the mysteries were the offspring of Egyptian priestcraft. They were instituted with a view to aggrandise that order of men, to extend their influence, and enlarge their revenues. To accomplish those selfish projects, they applied every engine towards besotting the multitude with superstition and enthusiasm. They taught them to believe, that themselves were the distinguished favourites of heaven; and that celestial doctrines had been revealed to them, too holy to be communicated to the profane rabble, and too sublime to be comprehended by vulgar capacities. It is, we confess, exceedingly probable, that after the mysteries were instituted, and had acquired an exalted reputation in the world, legislators, magistrates, judges, and potentates, joined in the imposture, with the same views and from the same principles. Princes and legislators, who found their advantage in overawing and humbling the multitude, readily adopted a plan which they found so artfully fabricated to answer these very purposes. They had interest enough with the sacerdotal (B) mystagogues, to induce them to allow them to participate in those venerable rites which had already established the authority of that description of men in whose hands they were deposited. The views of both parties were exactly congenial. The respect, the admiration, and dependence of the million, were the ultimate objects of their ambition respectively.—Priests and princes were actuated by the very same spirit. The combination was advantageous, and of consequence harmonious. For these reasons we have taken the liberty of differing from his lordship of Gloucester with respect to the persons who first instituted the secret mysteries of the Pagan religion.

8 adopted by legislators, &c.

Another writer, of considerable reputation in the republic of letters, is of opinion, that the mysteries were entirely commemorative; that they were instituted with a view to preserve the remembrance of heroes and great men, who had been deified in consideration of their martial exploits, useful inventions, public virtues, and especially in consequence of the benefits by them conferred on their contemporaries.—According to him, the (C) mysteries of Mithras were established for this very purpose. It would be no difficult matter to prove that the Persian deity of that name was the sun, and that his name and insignia jointly ascertain the truth of this assertion. The same writer extends this observation to the mysteries of the Egyptians, Phœnicians, Greeks, Hetruscans; and in a word, to all the institutions of that species throughout the world. In opposition to this singular opinion, it may be argued, we think with some show of reason, that the method of preserving the memory of great and illustrious men generally adopted, was the establishing festivals, celebrating games, offering sacrifices, singing hymns, dances, &c. We can recollect no secret mysteries instituted for that purpose at least in their original intention. If any usage of the commemorative kind was admitted, it was superinduced at some period posterior to the primary institution At the same time, upon the supposition that the orgia of Bacchus were the same with those of the Egyptian Osiris, and that the mysteries of Ceres exhibited at Eleusis were copied from those of the Egyptian Isis, and allowing that the former was the sun, and the latter the moon; it will be difficult to find out the human persons whose exploits, adventures, inventions,

9 Hypothesis of Mosheim

10 singular and indefensible.

(A) The Germans, Russians, and Scandinavians, who were never thoroughly civilized till the gospel was preached among them.

(B) The mystagogues were the ministers who acted the chief part in celebrating the mysteries.

(C) Principio hoc ego quidem controversia vacare, arbitror, mysteria quæ vocantur, ritus fuisse idcirco institutos ne memoria petiret veterum beneficiorum, inventorum, fatorum rerum gestarum quibus primi popul rum conditores, aut alii præclari homines, decus nomen, et famam, inter suos sibi comparaverant. Neque hæc cuiquam sententia mirabilis videri poterit. *Cud. Syst. Intellect. ed Moshemii*, p. 329.

inventions, &c. were intended to be immortalized by thoſe inſtitutions. Upon the whole, the myſteries were performed in ſecret; they were intended to be communicated only to a few: of courſe, had they been inſtituted with a view to immortalize the memory of heroes and great men, the authors would have acted the moſt fooliſh and inconſiſtent part imaginable.—Inſtead of tranſmitting the fame of their heroes with eclat to poſterity, they would by this procedure have conſigned it to eternal oblivion.

11 Our firſt poſition ſupported by the character of the prieſts of Egypt.

We muſt then recur to our firſt poſition. The myſteries were the offspring of bigotry and prieſtcraft; they originated in Egypt, the native land of idolatry. In that country the prieſthood ruled predominant. The kings were ingrafted into their body before they could aſcend the throne. They were poſſeſſed of a third part * of all the land of Egypt. The ſacerdotal function was confined to one tribe, and was tranſmitted unalienably from father to ſon. All the orientals, but more eſpecially the Egyptians, delighted in myſterious and allegorical doctrines. Every maxim of morality, every tenet of theology, every dogma of philoſophy, was wrapt up in a veil of allegory and myſticiſm. This propenſity, no doubt, conſpired with avarice and ambition to diſpoſe them to a dark and myſterious ſyſtem of religion. Beſides, the Egyptians were a gloomy † race of men; they delighted in darkneſs and ſolitude. Their ſacred rites were generally celebrated with melancholy airs, weeping, and lamentation. This gloomy and unſocial bias of mind muſt have ſtimulated them to a congenial mode of worſhip. In Egypt then we are to ſearch for the origin of the myſteries. Both the nature of the inſtitution and the genius of the people confirm this poſition; and hiſtorians, both ancient and modern, are agreed in admitting the certainty of the fact.

* Diodor. Sicul. Lib. I.

† Plutarch.

12 The Oſiris and Iſis of Egypt the Bacchus and Ceres of Greece.

The Oſiris of Egypt, every body knows, was the original Bacchus; as the Iſis of the ſame country was the Ceres of the Greeks. The rites of Oſiris were performed with loud ſhrieks and lamentations when he was put into the coffin; and with the moſt extravagant mirth, when he was in a manner raiſed from the dead, or ſuppoſed to be found again. Their hymns were upon the whole always compoſed in melancholy affecting ſtrains; and conſiſted of lamentations for the loſs of Oſiris, the myſtic flight of Bacchus, the wandering of Iſis, and the ſufferings † of the gods. The Canaanites, who were a kindred tribe of the Mizraim or Egyptians, imitated them in their ſacred rites. At Byblus, Berytus, Sidon, and afterwards at Tyre, they uſed particularly mournful dirges for the death of Adonis or Tammuz †, who was the ſame with the Egyptian Oſiris, *i. e.* the ſun.

† Plut. Iſ. et Oſir.

† Ezek. Chap. 8. and Nonni Dionyſ.

13 Death of Oſiris and wanderings of Iſis.

The Egyptians, then, naturally inclined to gloom and ſecrecy, inſtituted a mode of worſhip congenial with their natural diſpoſition of mind. The receſs of the ſun towards the ſouthern hemiſphere, was the death † of Oſiris; the wanderings of Iſis in ſearch of her huſband and brother, allegorically imported the longings of the earth * for the return of the fructifying influences of the ſolar heat.

† Macrob. Saturn.

* Plut. Iſ. et Oſir.

When that luminary returned towards the ſummer ſolſtice, and grain, trees, fruits, herbs, and flowers adorned the face of nature, another feſtival was celebrated of a very different complexion from that of the former. In this ſeaſon all Egypt was diſſolved in the moſt extravagant mirth and jollity. During the celebration of thoſe feſtivals, the prieſts formed allegorical repreſentations of the ſun and the earth (D). They perſonified the one and the other, and allegorized their motions, aſpects, relations, ſympathies, acceſſes, receſſes, &c. into real adventures, peregrinations, ſufferings, conteſts, battles, victories, defeats, and ſo forth. Theſe, in proceſs of time, were held up to the vulgar as real occurrences; and theſe in a few ages became the moſt eſſential articles of the popular creed. From this ſource were derived the conqueſts of Dionyſus or Bacchus, ſo beautifully exhibited by Nonnus in his Dionyſiacs; the wanderings of Io, wonderfully adorned by Æſchylus; and the labours of Hercules, afterwards uſurped by the Greeks.

14 The Egyptians deified departed heroes.

Whether the Egyptians deified mortal men in the earlieſt ages has been much controverted. Jablonſki * has taken much pains to prove the negative. Diodorus ‡ aſſures us that they paid their monarchs a kind of divine adoration, even in their lifetime. Plutarch tells us plainly § that ſome were of opinion that Iſis, Oſiris, Horus, Anubis, Typhon, were once mortal perſons, who were exalted into dæmons after their death. The Sicilian, in his hiſtory of Iſis and Oſiris, Pan, Hermes, &c. plainly repreſents them as human perſonages; and informs us, that the Egyptians imagined, that after their deceaſe they tranſmigrated into particular ſtars. From theſe authorities, we are inclined to believe that the Egyptians, as well as the other pagans, did actually deify perſons who had diſtinguiſhed themſelves in their days of nature by proweſs, wiſdom, uſeful arts, and inventions. This was a conſtant practice among the Greeks, who probably learned it from the people in queſtion.

* Panth. Egypt.

‡ Lib. i.

§ Iſ. & Oſir.

15 Secrets reſpecting the objects of worſhip revealed in the myſteries.

The exploits of thoſe heroes had been diſguiſed by allegorical traditions and hieroglyphical repreſentations. They had been magnified beyond all dimenſions, in order to aſtoniſh and intimidate the vulgar. They had been interlarded with the moſt extravagant fables, in order to gratify their propenſity towards the marvellous. All theſe ſecrets were developed in the myſteries. The catechumens (E) were informed of every particular relating to the birth, the life, the exploits, the adventures, the misfortunes, and deceaſe of thoſe heroic perſonages, and when, and by what means, they had attained to the high rank of divinities. At the ſame time we think it highly probable, that thoſe demigods were repreſented in their ſtate of exaltation and heavenly ſplendour. The magicians of Egypt were abundantly qualified for exhibiting *angels in machines*. The ſouls of virtuous men, who had not been eminent enough to merit the honour of deification, were ſhown in all the perfection of Elyſian felicity; and perhaps the

(D) Iſis, among the Egyptians, ſometimes ſignified the moon, and ſometimes the earth.

(E) Catechumens were pupils who were learning the elements of any ſcience.

the ſouls of tyrants, and of the children of (F) Typhon, were ſhown in Tartarus, ſuffering all the extremes of infernal puniſhment From theſe exhibitions the myſtagogues might naturally enough take occaſion to read their pupils ſuitable lectures on the happy tendency of a virtuous conduct, and the diſhonour and miſery conſequent upon a contrary courſe. They might ſet before them immortal renown, deification, and elyſium, on the one hand, and eternal infamy and miſery on the other. This will probably be deemed the chief advantage accruing from this inſtitution.

16 Chief advantage of the myſteries.

Beſides the communications above-mentioned, the catechumens were taught many ſecrets of phyſiology, or the nature of the phenomena of the world. This Pharnutus * every where affirms, eſpecially in his laſt book towards the end. Plutarch too informs us, that many of the Greek philoſophers were of opinion, that moſt of the Egyptian fables were allegorical details of phyſical operations. Euſebius acquaints us §, that the phyſiology, not only of the Greeks, but likewiſe of the barbarians, was nothing elſe but a kind of ſcience of nature, a concealed and dark theology, involved in fable and fiction, whoſe hidden myſteries were ſo veiled over with enigmas and allegories, that the ignorant million were as little capable of comprehending what was ſaid as what was ſuppreſſed in ſilence. This, ſays he, is apparent from the poems of Orpheus and the fables of the Phrygians and Egyptians. Dionyſius of Halicarnaſſus likewiſe obſerves ‡, that the fables of the Greeks detail the operations of nature by allegories. Proclus § makes the ſame obſervation concerning the people in queſtion. The Egyptians, ſays he, taught the latent operations of nature by fables,

* *De Nat. Deorum.*

§ *Prop. Evangel.*

‡ *Antiq. Rom.*

§ *In Tim.*

17 Phyſiological ſecrets expounded in the myſteries of Egypt.

Theſe phyſiological ſecrets were no doubt expounded to the initiated; and that the Egyptian prieſts were deeply ſkilled in phyſiological ſcience, can ſcarce be queſtioned, if we believe that Jannes and Jambres rivalled Moſes with their enchantments. The preceding detail comprehends all that was revealed to the Epoptæ in the original Egyptian myſteries. What articles might have been introduced afterwards we cannot pretend to determine.

Be that as it may, one thing is certain, namely, that the vulgar were excluded from all thoſe choice ſecrets, which were carefully reſerved for the nobility and ſocerdotal tribes. To them it was given to know the myſteries of the kingdom of darkneſs; but to thoſe who were without, all was myſtery and parable. While the laity fed on huſks, the clergy and the quality feaſted on royal dainties. The prieſts who had deviſed theſe allegories underſtood their original import, and bequeathed it as an ineſtimable legacy to their children. Here then we have the primary object of the myſteries, namely, to develope to the initiated the original and rational import of thoſe allegorical and myſtical doctrines which were tendered to the uninitiated, wrapt up in impenetrable allegory and obſcurity. To the former, theſe were communicated and explained: The latter were obliged to ſtand at an awful diſtance, and retire as the *Procul, O procul eſte profani*, thundered in their ears.

Theſe allegorical traditions originated in Egypt, (ſee MYTHOLOGY). It was the general bias of the oriental genius. The Egyptians, however, according to the moſt authentic accounts (G), were the greateſt proficients in that ſcience. The original ſubject of theſe inſtitutions were, we imagine, the articles we have ſpecified above: but in proceſs of time, according to the natural courſe of things, numerous improvements were made, and many new rites, ceremonies, uſages, and even doctrines, were ſuperinduced, which were utterly unknown to the original hierophants (H). Simplicity is for the moſt part one of the diſtinguiſhing characters of a new inſtitution; but ſucceeding architects generally imagine that ſomething is ſtill wanting to complete the beauty, the regularity, the uniformity, the magnificence, and perhaps the conveniency of the ſtructure. Hence, at length, it comes to be ſo overloaded with adventitious drapery, that its primary elegance and ſymmetry is altogether defaced. This was the caſe with the earlieſt Egyptian myſteries. Their ſubject was at firſt ſimple and eaſy to be comprehended; in time it became complex, intricate, and unintelligible.

18 Temples where the myſteries were celebrated.

In order to celebrate thoſe myſteries with the greater ſecrecy, their temples were ſo conſtructed as to favour the artifice of the prieſts. The fanes, in which they uſed to execute their ſacred functions, and to perform the rites and ceremonies of their religion, were ſubterraneous apartments, conſtructed with ſuch wonderful ſkill and dexterity, that every thing that appeared in them breathed an air of ſolemn ſecrecy. Their walls were covered with hieroglyphic paintings and ſculpture, and the altar was ſituated in the centre of the apartment. Modern * travellers have of late years diſcovered ſome veſtiges of them, and bear witneſs to the above deſcription of thoſe dark abodes (I). In thoſe ſubterraneous manſions, which the prieſts of that ingenious nation had planned with the moſt conſummate ſkill, the kings, princes, and great men of the ſtate, encountered the dangers and hardſhips contrived to prove their prudence, fortitude, patience, abſtinence, &c. Theſe were appointed to try their merit; and by theſe the hierophants were enabled to decide whether or not they were duly qualified for receiving that benefit. Upon thoſe occaſions, we may believe, abundance of thoſe magical tricks were exhibited, for which the magicians of Egypt were ſo much celebrated among the ancients. The ſtrange and aſtoniſhing ſights, the alternate ſucceſſions of light and darkneſs, the hideous ſpectres expoſed to view, the frightful howlings reechoed by theſe infernal domes, the ſcenes of Tartarus and

* *Nardon, Shaw, Pococke, &c.*

(F) Typhon was the evil genius, or devil of the Egyptians.

(G) As early as the age of Joſeph, the Egyptians were ſkilled in the interpretations of dreams, divinations, &c. and in the age of Moſes they were become wiſe men, magicians, &c.

(H) Hierophant imports a prieſt employed in explaining the doctrines, rites, &c. communicated to the initiated.

(I) See an excellent deſcription of theſe ſubterraneous abodes, and of the proceſs of probation carried on there, in a French romance, intitled *The Life of Sethos.*

and Elyſium, exhibited alternately and in quick ſucceſſion, muſt have made a deep and laſting impreſſion on the mind of the affrighted votary (K). Theſe ſcenes we ſhall deſcribe more fully in the ſequel.

19 The Grecian infernal regions copied from the Egyptian myſteries.

From the ſcenes exhibited in celebrating the Egyptian myſteries, eſpecially thoſe of Iſis and Oſiris, the Greeks ſeem to have copied their ideas of the infernal regions, and the ſubterraneous manſions of departed ſouls. Many colonies of Egyptians ſettled in Greece. From theſe the αοιδοι (L), or moſt early bards of Greece, learned them imperfectly. Of courſe, we find Homer's account of the infernal regions, and of the ſtate of departed ſouls, lame and incoherent. Succeeding bards obtained more full and more diſtinct information. Euripides and Ariſtophanes ſeem to have paved the way for the prince of Roman poets. Plato* and ſome of the other philoſophers have ſhown by their deſcriptions or alluſions, that the whole apparatus of Tartarus and Elyſium had become a hackneyed topic ſome centuries before Virgil was born. This incomparable poet borrowed his ideas from Homer, Ariſtophanes, Euripides, Plato, &c. Theſe, under his plaſtic hand, in the ſixth Æneid, grew into a ſyſtem beautiful, regular, uniform, and conſiſtent. The materials he has employed were created to his hand; he had only to collect, poliſh, arrange, and connect them.— The ſentiments collected from the Platonic philoſophy, and the inimitable epiſode copied from the annals of Rome, by the maſterly ſkill which he has diſplayed in the application of them, form the chief excellencies of the piece. For the reſt, he could well diſpenſe with going to Eleuſis (M): every old woman in Athens and Rome could repeat them.

* *Phædo.*

20 Myſteries brought from Egypt into Perſia and Greece.

Egypt was then the native land of myſteries as well as of idolatry. Every god and goddeſs reſpectively had their myſteries; but as thoſe of Iſis and Oſiris were the moſt celebrated, they of courſe became principal objects of purſuit as well as of imitation to the neighbouring nations. Theſe, as is generally believed, were carried into Perſia by Zoroaſtres, or Zorduſht, by whom they were conſecrated to Mithras. On theſe we ſhall make ſome obſervations in the ſequel.— Orpheus imported them into Thrace; Cadmus brought them into Boeotia, where they were ſacred to Bacchus. Inachus eſtabliſhed them at Argos in honour of Juno, the ſame with Iſis (N); Cyniras in Cyprus, where they were dedicated to Venus. In Phrygia they were ſacred to Cybele, the mother of the gods.

Our learned readers, who will probably reflect that the Egyptians were in ancient times inhoſpitable to ſtrangers, will perhaps be ſurpriſed that this faſtidious and jealous people were ſo ready to communicate the arcana of their religion to foreigners.— But they will pleaſe recollect, that a great part of Greece was planted with colonies from Egypt, Phœnicia, Paleſtine, &c. This we could eaſily prove, did the bounds preſcribed us admit ſuch a digreſſion. Orpheus, if not an Egyptian, was at leaſt of oriental extraction. Inachus, Cadmus, and Melampus, are univerſally allowed to have been Egyptians. Erechtheus, in whoſe reign the Eleuſinian myſteries were eſtabliſhed, was an Egyptian by birth, or at leaſt ſprung from Egyptian anceſtors. The Egyptians, then, in thoſe early ages, did not view the Greeks in the light of aliens, but as a people nearly related either to themſelves or the Phœnicians, who were their brethren. Upon this connection we imagine it was, that in later times moſt of the ſages of Greece, eſpecially of Athens, found ſo hoſpitable a reception among that people. They probably viewed them in the light of propagandi; apoſtles able and willing to diſſeminate their idolatrous rites. This obſervation, which might be ſupported by numberleſs authorities, did the nature of the preſent inquiry permit, will, we think, go a great way towards obviating the objection.

Although, as has been obſerved, every particular deity had his own peculiar myſterious ſacred rites, yet of all others thoſe of Mithras, Bacchus (O), and Ceres, were deemed the moſt auguſt, and were moſt univerſally and moſt religiouſly celebrated. To theſe, therefore, we ſhall in a good meaſure confine ourſelves upon this occaſion. If our readers ſhall become intimately acquainted with theſe, they may readily diſpenſe with the knowledge of the reſt, which are, indeed, no more than ſtreams and emanations from theſe ſources. We ſhall then, in the firſt place, preſent to our readers a brief ſketch of the myſteries of Mithras.

21 Myſteries of Mithras, Bacchus, and Ceres, the moſt auguſt.

Mithras, or, according to the Perſian, *Mihr*, was one of the great gods of the Aſiatics. His worſhip was for many ages confined to Perſia. Afterwards, however, it was propagated ſo far and wide, that ſome have imagined they had diſcovered veſtiges of it even in Gaul. *Mihr*, according to Dr Hyde*, ſignifies love, and likewiſe the *Sun*. If we might preſume to differ from ſo reſpectable an authority, we ſhould conjecture that it is a cognate of the Hebrew word *Muthir*, "excellentia, preſtantia." That there was an analogy between the Hebrew and old Perſian, is generally admitted by the learned. Be that as it may, Mithras was the ſun (P) among the Perſians; and in honour of

* *Relig. vet. Perſarum.*

(K) Perſons who had deſcended into Trophonius's vault were ſaid to have been ſo terrified with ſhocking ſights, that they never laughed during the remainder of their lives.

(L) Theſe were ſtrolling poets like our minſtrels, who frequented the houſes of the great men of Greece, and entertained the company upon public occaſions with ſinging and tales of other times.

(M) Biſhop Warburton has, with much ingenuity, and a vaſt profuſion of reading, endeavoured to prove that Virgil borrowed the whole ſcenery of the ſixth Æneid from the ſources mentioned in the text.

(N) Iſis was the moon, and the original Juno was the ſame planet.

(O) Bacchus was the Oſiris of the Egyptians, and Ceres was the Iſis of the ſame people.

(P) Moſheim, in his notes on Cudworth's Intellectual Syſtem, page 330, has taken much pains to prove that Mithras was a deified mortal; but we cannot agree with that learned man in this point.

22 Account of the myſteries of Mithras.

of that luminary this inſtitution was eſtabliſhed. Mithras, according to Plutarch (Q), was the middle god between Oramaz and Ariman, the two ſupreme divinities of Perſia. But the fact is, the ſolar planet was the viſible emblem of Oramaz, the good genius of the Perſian tribes, and the ſame with the Oſiris of the Egyptians. From theſe people, ſome have imagined that Zoroaſtres (R), or Zerduſht, borrowed his myſteries of Mithras. To this opinion we cannot give our aſſent, becauſe the probationary trials to be undergone by the candidates among the former were much more ſavage and ſanguinary than among the latter.—Both, however, were inſtituted in honour of the ſame deity; and probably the ſcenes exhibited, and the information communicated in both, were analogous; a circumſtance which perhaps gave birth to the opinion above-mentioned.

The grand feſtival of Mithras was celebrated ſix days, in the middle of the month Mihr (S). Upon theſe days, it was lawful for the kings of Perſia to get drunk and dance. On this feſtival, we imagine, the candidates for initiation, having duly proved their vocation, were ſolemnly admitted to the participation of the myſteries.

Zoroaſtres (T) worſhipped Mithras, or the Sun, in a certain natural cave, which he formed into a temple, and filled up in a manner exactly mathematical. There Mithras was repreſented as preſiding over the lower world with all the pomp of royal magnificence. In it too were ſeen the ſymbols of Mithras and of the world, philoſophically and mathematically exhibited, to be contemplated and worſhipped. This deity was ſometimes repreſented as mounted on a bull, which he is breaking, and which he kills with a ſword. On ſome bas reliefs ſtill exiſting, he appears as a young man with his tiara turned upward, after the manner of the Perſian kings. He is clothed with a ſhort tunic and breeches, after the Perſian faſhion. Sometimes he wears a ſmall cloke. By his ſides are ſeen other human figures, with tiaras of the ſame faſhion on their heads, but without clokes. One of theſe figures commonly holds in his one hand a torch lifted up; in the other one turned downward. Sometimes over the cave is ſeen the chariots of the ſun and moon, and divers conſtellations, ſuch as cancer, ſcorpion, &c.

23 Probationary exerciſes previous to initiation.

In one of thoſe caves the ceremonies of initiation were performed; but before the candidate could be admitted, he was forced to undergo a courſe of probationary exerciſes, ſo numerous and ſo rigorous, that very few had courage and fortitude enough to go thro' them. He was obliged to live a life of virtue and abſtinence for a ſpace of ſeven years previous to the period of his initiation. Some months before it, he was obliged to ſubmit to a long and auſtere faſt, which continued fifty days. He was to retire ſeveral days to a deep and dark dungeon, where he was ſucceſſively expoſed to all the extremes of heat and cold. Meantime he frequently underwent the baſtinado, which the prieſts applied without mercy. Some ſay this fuſtigation continued two whole days, and was repeated no leſs than 15 times. In the courſe of theſe probationary exerciſes, the candidate was generally reduced to a ſkeleton; and we are told, that there have been ſeveral inſtances of perſons who have periſhed in the attempt.

Upon the eve of the initiation, the aſpirant was obliged to* brace on his armour, in order to encounter giants and ſavage monſters. In thoſe ſpacious ſubterraneous manſions a mock hunting was exhibited. The prieſts and all the ſubordinate officers of the temple, transformed into lions, tygers, leopards, boars, wolves, and other ſavage creatures, aſſailed him with loud howlings, roaring, and yelling, and every inſtance of ferine fury. In thoſe mock combats, the hero was often in danger of being really worried, and always came off with bruiſes and wounds. Lampridius informs us, that when the emperor Commodus was initiated, he actually carried the joke too far, and butchered one of the prieſts who attacked him in the figure of a wild beaſt. The Perſians worſhipped Mithras or the Sun by a perpetual fire: hence the votary was obliged to undergo a fiery trial; that is, to paſs ſeven times through the ſacred fire, and each time to plunge himſelf into cold water. Some have made theſe probationary penances amount to 80; others have thought that they were in all only 8. As we find no good authority for either of theſe numbers, we think ourſelves at liberty to hazard the following conjecture: The number *ſeven* was deemed ſacred over all the eaſt. The Mythriac penances we imagine were either ſeven, or if they exceeded it, were regulated by ſeven repetitions of that number. The candidate having undergone all theſe torturing trials with becoming patience and fortitude, was declared a proper ſubject for initiation. But before his admiſſion he was obliged to bind himſelf by the moſt ſolemn oath, with horrible imprecations annexed, never to divulge any ſingle article of all that ſhould be communicated to him in the courſe of his initiation.

* *Jul. Firmicus.*

24 Oath of ſecrecy.

25 Revelations in the myſteries of Mithras.

What απορρητα or *ineffable ſecrets* were imparted to the initiated, it is impoſſible at this diſtance of time to diſcover with any tolerable degree of certainty. We may, however, reſt aſſured, that the moſt authentic tradition concerning the origin of the univerſe; the nature, attributes, perfections, and operations, of Oromaſd; the baleful influences of Ariman; and the benign

(Q) Iſis and Oſiris, page 369 l. 20, from the bottom. This philoſopher makes Zoroaſter, according to ſome, 5000 years prior to the Trojan war. This date is certainly extravagant. We cannot, however, agree with ſome moderns, who make him contemporary with Darius Hyſtaſpes, the immediate ſucceſſor of Cambyſes, becauſe it contradicts all antiquity.

(R) M. Silohwette, Diſſer. V. page 17. aſſerts that Zoroaſtres was initiated among the Egyptians.

(S) The month Mihr began September 30, and ended October 30.

(T) See Dr Hyde de Rel vet. Perſ. page 16, 17. Mr Bryant's Anal. vol. i. page 232. Porphyr. de autro Nymph, page 254. This philoſopher often mentions the cave of Mithras, and always attributes the inſtitution of his rites to Zoroaſter

nign effects of the government of Mithras, were unfolded and inculcated. The secret phenomena of nature, as far as they had been discovered by the magi, were likewise exhibited; and the application of their effects, to astonish and delude the vulgar, were taught both in theory and practice. The exercise of public and private virtues was warmly recommended; and vice represented in the most odious and frightful colours. Both these injunctions were, we may suppose, enforced by a display of the pleasures of Elysium and the pains of Tartarus, as has been observed above in describing the mysteries of the Egyptians.

Those initiations are mentioned by Lampridius in the life of Commodus, and likewise by Justin * and Tertullian ‡, who both flourished in the second century. The last of these two speaks of a kind of baptism, which washed from the souls of the initiated all the stains which they had contracted during the course of their lives prior to their initiation. He at the same time mentions a particular mark which was imprinted upon them (U), of an offering of bread, and an emblem of the resurrection; which particulars, however, he does not describe in detail. In that offering, which was accompanied with a certain form of prayer, a vessel of water was offered up with the bread. The same father elsewhere inform us, that there was presented to the initiated a crown suspended on the point of a sword; but that they were taught to say, *Mithras is my crown.* By this answer was intimated, that they looked upon the service of that deity as their chief honour and ornament.

* *Dial. cum Tryphone.*
‡ *De præscript. adver. Hæret.*

After that the Teletæ (X) were finished, the pupil was brought out of the cave or temple, and with great solemnity proclaimed a lion of Mithras (Y); a title which imported strength and intrepid courage in the service of the deity. They were now consecrated to the god, and were supposed to be under his immediate protection; an idea which of course animated them to the most daring and dangerous enterprises.

The worship of Mithras was introduced into the Roman empire towards the end of the republic, where it made very rapid progress. When Christianity began to make a figure in the empire, the champions for paganism thought of proposing to men the worship of this *power of benevolence*, in order to counterbalance or annihilate that worship which the Christians paid to Jesus Christ the true *Sun* of righteousness. But this mode was soon abolished, together with the other rites of paganism. The Persian grandees often affected names compounded with Mithras; hence Mithridates, Mithrobarzanes, &c.: Hence, too, the precious stone called *Mithridat* *, which by the reflexion of the sun sparkled with a variety of colours. There is likewise a certain pearl of many different colours, which they call *Mithras*. It is found among the mountains near the Red Sea; and when exposed to the sun, it sparkles with a variety of dyes. We find likewise a king of Egypt of that name who reigned at Heliopolis; who being commanded in a dream to erect an obelisk to the solar deity, reared a most prodigious one in the neighbourhood of that city.

* *Solinus*, cap. 10.

26
Mithras said to have sprung from a rock.

The votaries of Mithras pretended that he was sprung from a rock, and that therefore the place where the mysterious ceremonies were communicated to the initiated was always a cave. Many different reasons have been assigned for the origin of this rock-born deity, most of which appear to us unsatisfactory. If our readers will be obliging enough to accept of a simple and obvious conjecture, they may take the following: A rock is the symbol of strength and stability (Z): the dominion of Mithras, in the opinion of his votaries, was firm as a rock, and stable as the everlasting hills. If our readers should not admit the probability of this conjecture, we would beg leave to remit them to the learned Mr Bryant's *Analysis of Mythology*, where they will find this point discussed with deep research and wonderful ingenuity. Whatever may have been the origin of this opinion with relation to the birth of Mithras, it is certain that some reverence to rocks and caves was kept up a long time even after the establishment of Christianity. Hence the prohibition given to some of the proselytes to that religion, that they should no more presume to offer up their prayers *ad petras* at the rocks (A).

We shall conclude our account of the mysteries of Mithras with a passage from Mr Anquetil, to whom we are so much indebted for what knowledge we have of the Persian theology, and in which the functions of that deity are briefly and comprehensively delineated. "The peculiar functions of Mithras are to fight continually against Abriman and the impure army of evil genii, whose constant employment is to scatter terror and desolation over the universe; to protect the frame of nature from the demons and their productions. For this purpose he is furnished with a thousand ears and a thousand eyes, and traverses the space between heaven and earth,

(U) In allusion to this practice of imprinting a sacred mark, probably on the forehead of the initiated, we find the injunction to the angel, Ezek. chap. ix. ver. 4. and the Revelation *passim*.

(X) The mysteries were called *Teletæ*, which imports, "the rites which confer perfection."

(Y) *Tertull. adv. marc.* p. 55. The priests of Mithras were called the *lions of Mithras*, and his priestesses *lionesses*; some say *hyænas*. The other inferior ministers were called *eagles*, *hawks*, *ravens*, &c. and on their festivals they wore masks corresponding to their titles, after the Egyptian manner, where the priests appeared at the ceremonies with masks resembling the heads of lions, apes, dogs, &c. a circumstance which furnishes a presumption that the mysteries of Mithras were of Egyptian original.

(Z) Our Saviour probably alludes to this emblem, when he talks of *building his church on a rock;* and adds, *that the gates of hell should not prevail against it.*

(A) The Caledonian druids seem to have regarded certain stones with a superstitious veneration, in which the Catholics imitated them. There are in several places of Scotland large stones, which the vulgar call *lecre* stones, *i. e.* we imagine, *lecture*.

earth, his hands armed with a club or mace. Mithras gives to the earth light and sun: he traces a course for the waters: he gives to men corn, pastures, and children: to the world virtuous kings and warriors; maintains harmony upon earth, watches over the law, &c." As the history of Mithras, and the nature of his mysteries, are not generally known, we imagined it would be agreeable to many of our readers to have the most important articles relating to that subject laid before them as it were in detail.

27 Mysteries of Bacchus.

We now proceed to the orgia, or mysteries of Bacchus, which we shall introduce with a brief history of that deity. The original Dionysus or Bacchus was the Osiris of the Egyptians, which last was the Sun (B). Whether there was an Egyptian monarch of that name, as Diodorus Siculus affirms§, has no manner of connection with the present disquisition. The Greek name of that deity is plainly oriental, being compounded of *di*, "bright;" and *nasia* or *nasa*, in the Æolic dialect *nusa*, "a prince." This name was imported from the east by Orpheus, Cadmus, or by whoever else communicated the worship of Osiris to the Greeks.

§ *Lib.* 1.

28 Bacchus the same with Osiris.

That the Dionysus of the Greeks was the same with the Osiris of the Egyptians, is universally allowed. Herodotus tells us expresly*, that *Osiris* is *Dionysus* in the Greek language: Martianus Capellus, quoted above, expresses the very same idea‖. The original Osiris was then the sun; but the Dionysus or Bacchus of the Greeks was the same with the Osiris of the Egyptians; therefore the Bacchus or Dionysus of the Greeks was likewise the same luminary.

* *Lib.* 2. *cap.* 144.

‖ *Theol. Egyp. lib.* 2. *cap* 1.

The name *Osiris* has much embarrassed critics and etymologists. The learned Jablonski‡, instead of delineating the character, attributes, operations, adventures, exploits, and peculiar department assigned this deity by his votaries, has spent much of his pains on trying to investigate the etymology of his name. If it is granted, which is highly probable, that the Hebrew and Egyptian tongues are cognate dialects, we should imagine that it is actually the *Ghosher* or *Oshir* of the former language, which imports, "to make rich, to become rich." Indeed the words *Osiris* and *Isis* were not the vulgar names of the sun and moon among the Egyptians, but only epithets importing their qualities. The name of the sun among that people was *Phri* or *Phry*, and that of the moon *Ioh*, whence the Greek *Io*. The term *Osiris* was applied both to the sun and to the river Nile; both which by their influence contributed respectively to enrich and fertilize the land of Egypt.

‡ *Panth. Egyp.*

It was a general custom among the orientals to denominate their princes and great men from their gods, demigods, heroes, &c. When the former were advanced to divine honours, they were in process of time confounded with their archetypes. The original divinities were forgotten, and these upstart deities usurped their place and prerogatives. In the earliest periods of the Egyptian monarchy, there appeared two illustrious personages, Osiris and Isis. These were the children of Cronus; and being brother and sister, they were joined in matrimony, according to the custom of the Egyptians. As the brother and husband had assumed the name of the *Sun*, so the sister and consort took that of *Isis*, that is, "the woman*," a name which the Egyptians applied both to the moon and to the earth, in consequence of the similarity of their nature, their mutual sympathy, and congenial fecundity.

* *Horapol.* *cap.* 3.

29 Exploits of Osiris.

Osiris having left his consort Isis regent of the kingdom, with Hermes as her prime minister, and Hercules as general of her armies, quitted Egypt with a numerous body of troops, attended by companies of fauns (C), satyrs, singing women, musicians, &c. traversed all Asia to the eastern ocean. He then returned homeward through the Upper Asia, Thrace, Pontus, Asia Minor, Syria, and Palestine. Wherever he marched, he conferred numberless benefits on the savage inhabitants. He taught the art of cultivating the ground, preserving the fruits of the earth, and distinguishing the wholesome and nutritive from the unwholesome and poisonous. He instructed them in the culture of the vine; and where vines could not be produced, he communicated to them the method of producing a fermented liquor from barley, very little inferior to wine itself. He built many cities in different parts of the globe, planted numerous colonies (D), and wherever he directed his course instituted just and wholesome laws, and established the rites and ceremonies of religion, and left priests and catechists of his train to teach and inculcate the observance of them. In short, he left every where lasting monuments of his progress, and at the same time of his generosity and beneficence. Where he found the people docile and submissive, he treated them with kindness and humanity: if any showed themselves obstinate, he compelled them to submit to his institutions by force of arms.

At the end of three years, he returned to Egypt, where his brother Typhon, a wicked unnatural monster, had been forming a conspiracy against his life. This traiterous design he soon after accomplished in the following manner: He invited Osiris, with some other persons whom he had gained over, to an entertainment. When the repast was finished, he produced a beautiful coffer, highly finished, and adorned with studs of gold; promising to bestow it on the person whom it should fit best. Osiris was tempted to make the experiment. The conspirators nailed down the cover upon him, and threw the coffer into the river. This coffer, which was now become the coffin of Osiris, was, they tell us, wafted by the winds and waves to the neighbourhood of Byblus, a city of Phœnicia, where it was cast on shore, and left by the waves at the foot of a tamarind tree.

30 His death.

Isis, in the mean time, disconsolate and forlorn, attended

(B) See Macrob. lib. i. cap. 21. p 247. bottom. Diogenes Laert. in proœmio, par. 10. Martian. Capel. Lib. 2. Jablonski, vol. i lib. ii. p. 415. par. 3. Plut. Isis Osir. *passim*.

(C) Men and women dressed in the habits of those rural deities.

(D) Many have thought this expedition fabulous; but the numberless monuments of Egyptian architecture, sculpture, statuary, lately discovered in the east, confirm it.

31 Wanderings of Iſis in ſearch of his body.

tended by Anubis, was ranſacking every quarter in ſearch of her beloved Oſiris. At length being informed by her faithful attendant and guardian, that his body was lodged ſomewhere in the neighbourhood of Byblus, ſhe repaired to that city. There, they ſay, ſhe was introduced to the queen, and after (E) a variety of adventures ſhe recovered the corpſe of her huſband, which, of courſe, ſhe carried back with her to Egypt: but the miſchievous Typhon, ever on the watch, found her on the banks of the Nile; and having robbed her of her charge, cut the body into 14 parts, and ſcattered them up and down. Now, once more, according to the fable, Iſis ſet out in queſt of thoſe parts, all of which, only one excepted, ſhe found, and interred in the place where ſhe found them; and hence the many tombs of Oſiris in that country. Theſe tombs were denominated *tapoſins* by the natives. Many other fabulous adventures were aſcribed to thoſe two perſonages, which it is not our province to enumerate at preſent. If our readers ſhould wiſh to be more minutely informed on this ſubject, they may have recourſe to the authors mentioned in the laſt-quoted author, or to the learned Mr Bryant's Analyſis of Ancient Mythology, and M. Cour de Gebelin, where they will find matter enough to gratify their curioſity.

32 The myſteries of Iſis and Oſiris inſtituted in commemoration of thoſe adventures.

To commemorate thoſe adventures, the myſteries of Iſis and Oſiris were inſtituted; and from them both thoſe of Bacchus and Ceres, among the Greeks, were derived. Of the Egyptian ſolemnity, we have an exact epitome in one of the fathers of the church to the following purpoſe: "Here follows (ſays he) an epitome of the myſteries of Iſis and Oſiris. They deplore annually, with deep lamentations and ſhaved heads, the cataſtrophe of Oſiris over a buried ſtatue of that monarch. They beat their breaſts, mangle their arms, tear open the ſcars of their former wounds; that by annual lamentations the cataſtrophe of his miſerable and fatal death may be revived in their minds. When they have practiſed theſe things a certain number of days, then they pretend that they have found the remains of his mangled body; and having found them, their ſorrows are lulled aſleep, and they break out into immoderate joy." What maxims of morality, ſecrets of phyſiology, or phenomena of aſtronomy, were couched under this allegorical proceſs, is not our buſineſs to inveſtigate in this place. We ſhall only obſerve, that, in all probability, Oſiris and Iſis were ſovereigns of Egypt at a very early period; that they had conferred many ſignal benefits on their ſubjects, who, influenced by a ſenſe of gratitude, paid them divine honours after their deceaſe; that in proceſs of time they were confounded with the ſun and the moon; and that their adventures were at length magnified beyond all credibility, interlarded with fables, and allegories, and employed in the myſteries as channels to convey a variety of inſtructions to the initiated.

33 Transferred to Byblus and Tyre, where Oſiris was called *Adonis* and *Bacchus*;

Be that as it may, it is certain that the very ſame mode of worſhip was eſtabliſhed at Byblus, and in after ages transferred to Tyre. The Mizraim and Chanaanim were nearly connected by blood, and their religious ceremonies were derived from the very ſame ſource. By what medium the worſhip of Oſiris at Abydus and Tyre was connected, we ſhall leave to others to explain; we ſhall only obſerve, that among the Phœnicians this deity obtained the names *Adonis* and *Bacchus*. The former is rather an (F) epithet than a name: the latter is evidently an alluſion to the weeping and lamentation (G) with which the rites were performed. We find another name of that divinity mentioned in Scripture (H); but that term is plainly of Egyptian original: we ſhall now proceed to the myſteries of Oſiris as they were celebrated among the Greeks and Thracians, under the name of the *Orgia of Dionyſus* or *Bacchus* *.

* *Diod. Sicul. Voſſius de Idol.*

Orpheus the celebrated Thracian philoſopher had travelled into Egypt in queſt of knowledge; and from that country, according to the moſt authentic accounts, he imported the bacchanalian rites and inſtitutions. Some have affirmed that this ſame Orpheus being intimately acquainted with the family of Cadmus, communicated theſe rites to them, and endeavoured to transfer them to the grandſon of that hero, which grandſon became afterwards the Grecian Bacchus. It is, however, we think, much more probable, that thoſe rites were imported from Egypt or Phœnicia, by (I) Cadmus himſelf, who was a native of the former country, and is thought to have ſpent ſome time in the latter, before he emigrated in queſt of a ſettlement in Bœotia. It is ſaid that Semele, the daughter of Cadmus, and the mother of the Grecian Bacchus, was ſtruck with lightning at the very inſtant of his birth. The child was, in all probability, denominated *Bacchus* (K), from the ſorrow and lamentation this melancholy accident had occaſioned in the family. Cadmus, in order to conceal the diſhonour of his daughter, might, we imagine, convey away his infant grandſon to ſome of his relations in Phœnicia or

34 And thence imported by Cadmus into Bœotia.

(E) For the conqueſts and adventures of Oſiris and Iſis, we muſt ſend our learned readers to Diod. Sic. Bibli, l. i. and Plut. Iſis and Oſiris, p. 256. et ſeq. which we have been obliged to abridge, in conſequence of the narrow limits preſcribed us.

(F) Adonis is evidently the Hebrew *Adoni*, "my lord," and imports the ſovereignty of the deity.

(G) Bacchus is derived from the Phœnician word *bahah*, "to weep." This was the name embraced by the Romans.

(H) Ezek. chap. 8. ver. 14. *tammuz* is the name of one of the months of the Egyptian year.

(I) Cadmus and Melampus, who were both Egyptians, introduced the Bacchanalia into Greece. The Egyptian or oriental name of Bacchus was *Dinuſi*, that is "the prince of light." Cadmus had learned the name *Bacchus* from the Phœnicians.

(K) We have omitted the immenſe farrago of fable relating to the connection between Jupiter and Semele, as of little importance to our readers.

or Egypt. There he was educated and instructed in all the mysteries of Isis and Osiris, and at the same time initiated in all the magical or juggling tricks of the Egyptian priests and Hierophants. Thus accomplished, when he arrived at manhood he returned to Thebes with the traditional retinue of the original deity of the same name; and claimed divine honours accordingly. This claim, however, was not admitted without much opposition; Pentheus, another grandson of Cadmus, was torn to pieces by the frantic Bacchanalians upon mount Citheron, because he attempted to interrupt them in celebrating the orgia. Some have thought that Cadmus lost his kingdom for the same reason; but this we think is by no means probable: we should rather imagine that the old prince was privy to the whole process, and that it was originally planned by him, with a view to attract the veneration of his new subjects, by making them believe that there was a divinity in his family.

35 The actions of Osiris attributed to the Grecian Bacchus.

Be that as it may, the vain-glorious Greeks attributed all the actions of the Egyptian hero to their new Bacchus: and according to their laudable practice, engaged him in numberless adventures in which his prototype had no share. Most of those are futile and unintertaining (L). The Greeks commonly adopted some oriental personage as the hero of their mythological rhapsodies. Him they naturalised and adopted into some Grecian family, and so he became their own. To him they ascribed all the adventures and exploits of the oriental archetype from whom he was copied. Consequently in the orgia (M), every thing was collected that had been imported from the east relating to Osiris; and to that farrago was joined all that the Grecian rhapsodists had thought fit to invent in order to amuse the credulous multitude. This, however, was not the whole of the misfortune: The adventures of Osiris were described by the Egyptian Hierophants, veiled with allegorical and hieroglyphical mysteries. These the persons who imported them into Greece did not thoroughly comprehend, or if they did, they were not inclined to communicate them sound and unsophisticated. Besides, many oriental terms were retained, the import of which was in process of time lost or distorted. Hence the religious ceremonies of the Greeks became a medley of inconsistencies. The mysteries of Bacchus, in particular, were deeply tinctured with this meritricious colouring; the adventures of the Theban pretender were grafted upon those of the Egyptian archetype, and out of this combination was formed a tissue of adventures disgraceful to human nature, absurd, and inconsistent. Indeed the younger or Theban Bacchus seems to have been a monster of debauchery; whereas the Egyptian is represented as a person of an opposite character. Of course the mysteries of the former were attended with the most shocking abominations.

36 Mysteries of Bacchus spread into Greece, &c.

These mysteries, as has been observed above, were first celebrated at Thebes the capital of Bœotia, under the auspices of the family of Cadmus. From this country they gradually found their way into Greece, and all the neighbouring parts of Europe. They were celebrated once every three years (N), because at the end of three years Osiris returned from his Indian expedition. As the Greeks had impudently transferred the actions of the Egyptian hero to their upstart divinity, the same period of time was observed for the celebration of those rites in Greece that had been ordained for the same purpose in Egypt.

When the day appointed for the celebration of the orgia (O) approached, the priests issued a proclamation, enjoining all the initiated to equip themselves according to the ritual, and attend the procession on the day appointed. The votaries were to dress themselves in coats of deer-skins, to loose the fillets of their hair, to cover their legs with the same stuff with their coats, and to arm themselves with thyrsi, which were a kind of spears wholly of wood entwined with leaves and twigs of the vine or ivy. It is said that the Bacchanalians, especially the Thracians, used often to quarrel and commit murder in their drunken revels; and that in order to prevent those unlucky accidents, a law was enacted, that the votaries instead of real spears should arm themselves with those sham weapons which were comparatively inoffensive. The statue of the deity, which was always covered with vine or ivy leaves, was now taken down from its pedestal, and elevated on the shoulders of the priests. The cavalcade then proceeded nearly in the following manner:

37 Process of their celebration.

First of all, hymns were chanted in honour of Bacchus, who was called the *Power of dances, smiles, and jests;* while at the same time he was deemed equally qualified for the exploits of war and heroism. Horace, in some of his dithyrambic odes, has concisely pointed out the subjects of those Bacchanalian songs. In the collection of hymns fabulously attributed to Orpheus, we find several addressed to this deity (P), each

(L) Nonnus, an Egyptian of Pentapolis, has collected all the fabulous adventures of Bacchus, and exhibited them in a beautiful but irregular poem: To this we must refer our learned readers. Of the Dionysiacs we have a most judicious sketch, *Geblin. Calend.* p. 553. et seq.

(M) The orgia belonged to all the Mydones, but to those of Bacchus in a peculiar manner.

(N) Hence these origia were called *Triteria.*

(O) According to Clem. Alexand. Cohort. pag. 12. Pott. the word *orgia* is derived from *orge*, which signifies "anger," and originated from the resentment of Ceres against Jupiter, in consequence of a most outrageous insult he had offered her with success. We should rather imagine it derived from the Hebrew word *argoz*, signifying a "chest or coffer," alluding to the casket which contained the sacred symbols of the god.—The Egyptians or Phœnicians might write and pronounce, argoz, *orgoz*, or in some manner nearly resembling *orgia.*

(P) These stand between the 41 and 52; one to Lenæus, or the presser; one to Libnites, or the winnower; one to Bessareus, or the vintager; one to Sabazius the god of rest; to Myses, or the Mediator, &c.

each under a different title, derived from the different appellations of the god. All theſe names are of oriental original, and might eaſily be explained, did the bounds preſcribed us admit of etymological diſquiſitions.

The hymn being finiſhed, the firſt diviſion of the votaries proceeded, carrying a pitcher of wine, with a bunch of the vine. Then followed the he-goat; an animal odious to Bacchus, becauſe he ravages the vines. The chanting the hymns, the ſacrificing the he-goat, and the revels, games, and diverſions, with which the celebration of thoſe rites was attended, gave birth to the dramatic poetry of the Greeks; as the perſons habited in the dreſs of Fauns, Sylvans, and Satyrs (Q), furniſhed the name of another ſpecies of poetry of a more coarſe and forbidding aſpect.

38 The myſterious coffer, with its contents.

Then appeared the myſterious coffer or baſket, containing the ſecret ſymbols of the deity. Theſe were the phallus (R), ſome grains of ſeſama, heads of poppies, pomegranates, dry ſtems, cakes baked of the meal of different kinds of corn, ſalt, carded wool, rolls of honey, and cheeſe; a child, a ſerpent (S), and a fan (T). Such was the furniture of the ſacred coffer carried in the ſolemn Bacchanalian proceſſion. The inventory given by ſome of the fathers ‡ of the church is ſomewhat different. They mention the dye, the ball, the top, the wheel, the apples, the looking-glaſs, and the fleece. The articles firſt mentioned ſeem to have been of Egyptian original; the laſt were certainly ſuperinduced by the Greeks, in alluſion to his being murdered and torn in pieces when he was a child by the machinations of Juno, who prevailed with the Titans to commit the horrid deed. Theſe laſt ſeem to have been memorials of his boyiſh play-things; for, ſays Maternus, "the Cretans §, in celebrating the rites of the child Bacchus, acted every thing that the dying boy either ſaid, or did, or ſuffered. They likewiſe (ſays he) tore a live bull in pieces with their teeth, in order to commemorate the diſmembering of the boy." For our part, we think, that if ſuch a beaſtly rite was practiſed, it was done in commemoration of the ſavage manner of life which had prevailed among men prior to the more humane diet invented and introduced by Iſis and Oſiris. Be that as it may, we learn from Porphyry *, that in the iſland of Chios they uſed to ſacrifice a man to Bacchus, and that they uſed to mangle and tear him limb from limb. This was no doubt practiſed in commemoration of the cataſtrophe mentioned above.

‡ *Clem. Alexand.*

§ *De Errore Prof. Gent.*

39 Human ſacrifices.

* *De Abſtinentia.*

The orgia of this Pagan god were originally ſimple enough; but this unſophiſticated mode was of no long continuance, for riches ſoon introduced luxury, which quickly infected even the ceremonies of religion. On the day ſet apart for this ſolemnity, men and women crowned with ivy, their hair diſhevelled, and their bodies almoſt naked, ran about the ſtreets, roaring aloud *Evohe* (U) Bacche. In this rout were to be ſeen people intoxicated at once with wine and enthuſiaſm, dreſſed like Satyrs, Fans, and Silenuſes, in ſuch ſcandalous poſtures and attitudes, with ſo little regard to modeſty and even common decency, that we are perſuaded our readers will readily enough forgive our omitting to deſcribe them. Next followed a company mounted upon aſſes, attended by Fawns, Bacchanals, Thyades, Mimallonides, Naiads, Tityri, &c. who made the adjacent places echo to their frantic ſhrieks and howlings. After this tumultuous herd were carried the ſtatues of victory and altars in form of vineſets crowned with ivy, ſmoking with incenſe and other aromatics. Then appeared ſeveral chariots loaded with thyrſi, arms, garlands, caſks, pitchers, and other vaſes, tripods, and vans. The chariots were followed by young virgins of quality, who carried the baſkets and little boxes, which in general contained the myſterious articles above enumerated. Theſe, from their office, were called *ciſtophoræ*. The phallophori (X) followed them, with a chorus of Itophallophori habited like Fauns, counterfeiting drunk perſons, ſinging in honour of Bacchus ſongs and catches ſuited to the occaſion. The proceſſion was cloſed by a troop of Bacchanalians crowned with ivy, interwoven with branches of yew and with ſerpents *. Upon ſome occaſions, at thoſe ſcandalous feſtivals, naked women whipped themſelves, and tore their ſkin in a moſt barbarous manner. The proceſſion terminated on mount Citheron, when it ſet out from Thebes; and in other places, in ſome diſtant unfrequented deſert, where the votaries practiſed every ſpecies of debauchery with ſecrecy

40 Total contempt of decency.

* *Ovid. Met.*

(Q) Dacier, Caſaubon, and other French critics, have puzzled and perplexed themſelves to little purpoſe about the origin of this word, without conſidering that it was coeval to dramatic poetry.

(R) The phallus was highly reſpected by the Egyptians, and was uſed as the emblem of the fecundity of the human race.

(S) That reptile was in high veneration among the Egyptians. See Euſeb. Præp. Evang. l. i. pag. 26. Steph. where we have a minute detail of the ſymbolical properties of that creature, according to Taautos the great legiſlator of that people.

(T) Servius in Georg. I. Virg. ver. 166. Myſtica *vanus* Jacchi. The fan, ſays he, is an emblem of that purifying influence of the myſteries by which the initiated were cleanſed from all their former pollutions, and qualified for commencing a holy courſe of life.

(U) Clem. Alexand. Cohort. pag. 11. Pott. derives this word from *Cheveh*, the mother of mankind, who firſt opened the gate to that and every other error; but we are rather inclined to believe that it comes from the oriental word *Hevé*, which ſignifies a "ſerpent;" which among the Egyptians was ſacred to the ſun, and was likewiſe the emblem of life and immortality. It then imported a prayer to Bacchus for life, vigour, health, and every other bleſſing.

(X) The phallus was the ſymbol of the fructifying power of Nature. The Itophallus was the type of that power in act.

crecy and impunity. Orphens faw the degeneracy of thofe ceremonies; and in endeavouring to reform them he probably loft his life. Pentheus fuffered in the like attempt, being torn in pieces by the Bacchanalians on mount Citheron, among whom were his own mother and his aunts. The Greeks, who were an airy jovial people, feem to have paid little regard to the plaintive part of the orgia; or rather, we believe, they acted with howling and frantic exclamations, often enhanced by a combination of drunkennefs, ecftafy, and enthufiaftic fury.

41 Doctrines inculcated in the orgia.

What fecrets, religious, moral, political, or phyfical, were communicated to the votaries, it is impoffible to determine with any degree of certainty.—One thing we may admit, namely, that the doctrines difcovered and inculcated in the orgia, were originally the very fame which the apoftles of the fect had imbibed in Egypt and Phœnicia; and of which we have given a brief account near the beginning of this article. It is, however, probable, that the fpurious or Theban Bacchus had fuperadded a great deal of his own invention, which, we may believe, was not altogether fo found and falubrious as the original doctrine. However that may be, the initiated were made to believe that they were to derive wonderful advantages ‡ from the participation of thofe rites, both in this life and that which is to come. Of this, however, we fhall talk more at length by and by in our account of the Eleufinian myfteries.

To detail the etymology of the names of this Pagan deity, the fables relating to his birth, his education, his transformations, his wars, peregrinations, adventures, the various and multiform rites with which he was worfhipped, would fwell this article to a moft immoderate fize. If any of our readers fhould wifh to be more minutely and more accurately acquainted with this fubject, we muft beg leave to remit them to Diod. Sic. Apollod. Bibl. Euripid. Bacchæ. Ariftophane Ranæ, Nonn Dionyf. and among the moderns, to Ban. Mythol. Voff. de origi. Idol. Monf. Fourmont, Reflexions fur l'origine anciens peuples, Mr Bryant's Analyf. and efpecially to Mons Cour de Gebelin, Calendries ou Almanach. That prince of etymologifts, in his account of the feftival of Bacchus, has given a moft acute and ingenious explication of the names and epithets of that deity. For our part, we have endeavoured to collect and exhibit fuch as we judged moft important, moft entertaining, and moft inftructive, to the lefs enlightened claffes of our readers.

42 Eleufinian myfteries inftituted in honour of Ceres.

We now proceed to the Eleufinian myfteries, which, among the ancient Greeks and Romans, were treated with a fuperior degree of awe and veneration. Thefe were inftituted in honour of Ceres, the goddefs of corn; who, according to the moft authentic accounts, was the Ifis of the Egyptians. The myfteries of Ofiris and Ifis have been hinted at in the preceding part of this article. They were originally inftituted in hohour of the fun and moon, and afterwards confecrated to an Egyptian prince and princefs; who, in confequence of their merits, had been deified by that people. We know of no more exact and brilliant defcription of the ceremonies of that goddefs, in the moft polifhed ages of the Egyptian fuperftition, than what we meet with in the witty and florid Apuleius *, to which we muft take the liberty to refer our more curious readers. Our bufinefs at prefent fhall be to try to inveftigate by what means, and upon what occafion, thofe myfteries were introduced into Attica, and eftablifhed at Eleufis. A paffage from Diodorus Siculus §, which we fhall here tranflate, will, we think, throw no inconfiderable light on that abftrufe part of the fubject.

43 On what occafion introduced into Attica.

"In like manner with him (Cecrops), fays that judious hiftorian, they tell us, that Erectheus, a prince of Egyptian extraction, once reigned at Athens. Of this fact they produce the following evidence: A fcorching drought, during the reign of this prince, prevailed over almoft all the habitable world, except Egypt; which, in confequence of the humidity of its foil, was not affected by that calamity. The fruits of the earth were burnt up; and at the fame time multitudes of people perifhed by famine. Erectheus, upon this occafion, as he was connected with Egypt, imported a vaft quantity of grain from that country to Athens. The people, who had been relieved by his munificence, unanimoufly elected him king. Being invefted with the government, he taught his fubjects the myfteries of Ceres at Eleufis and the mode of celebrating the facred ceremonies, having tranferred from Egypt the ritual for that purpofe. In thofe times the goddefs is faid to have made her appearance at Athens three feveral times; becaufe, according to tradition, the fruits of the earth which bear her name were then imported into Attica. On this account the feeds and fruits of the earth were faid to be the invention of that deity. Now the Athenians themfelves acknowledge, that, in the reign of Erectheus, the fruits of the earth having perifhed for want of rain, the arrival of Ceres in their country did actually happen, and that along with her the bleffing of corn was reftored to the earth. They tell us at the fame time, that the teletæ and the myfteries of that goddefs were then received and inftituted at Eleufis."

Here then we have the whole myftery of the arrival of Ceres in Attica, and the inftitution of her myfteries at Eleufis unveiled. The whole is evidently an oriental allegory. The fruits of the earth had been deftroyed by a long courfe of drought: Egypt, by its peculiar fituation, had been preferved from that dreadful calamity. Erectheus, in confequence of his relation to the Egyptians, imported from their country a quantity of grain, not only fufficient for the confumption of his own fubjects, but alfo a great overplus to export to other parts of Greece, Sicily, Italy, Spain, &c. Triptolemus, another Egyptian, was appointed by Erectheus to export this fuperfluous ftore. That hero, according to Pherecydes, was the fon of Oceanus and Tellus, that is, of the fea and the earth; becaufe his parents were not known, and becaufe he came to Eleufis by fea. The fhip in which he failed, when he diftributed his corn to the weftern parts of the world, was decorated with the figure of a winged dragon: therefore, in the allegorical ftyle of his country, he was faid to be wafted through the air in a chariot drawn by dragons. Thofe creatures, every body knows, were held facred by the Egyptians.

Wherever Triptolemus difpofed of his corn, thither were extended the wanderings of Ceres. In order to elucidate

* Lib. 11.

§ Lib. 1.

elucidate this point, we muſt obſerve, that along with the grain imported from Egypt, Erectheus, or Triptolemus, or both, tranſported into Attica a cargo of prieſts and prieſteſſes from the temples of Buſiris, a city which lay in the § centre of the Delta, where the goddeſs Iſis had a number of chapels erected for her worſhip. The preſidents of theſe ceremonies, like all other bigots, gladly laid hold on this opportunity of propagating their religious rites, and diſſeminating the worſhip of the deities of their country. That the Egyptian prieſts were zealous in propagating the dogmas of their ſuperſtition, is abundantly evident from the extenſive ſpreading of their rites and ceremonies over almoſt all Aſia and a conſiderable part of Europe. The Greek and Roman idolatry is known to have originated from them; and numberleſs monuments of their impious worſhip are ſtill extant in Perſia ‡, India, Japan, Tartary, &c. Our inference then is, that the worſhip of Iſis was introduced into every country where Triptolemus ſold or diſpoſed of his commodities.—Hence the wanderings of Ceres in ſearch of her daughter Proſerpine, who is generally called *Core.* The famine occaſioned by the drought deſtroying the fruits of the ground, imports the loſs of Proſerpine. The reſtoration of the corn in various parts of the earth, by freſh ſupplies from Egypt from time to time, imports the wanderings of Ceres in queſt of Proſerpine. The whole proceſs is an oriental allegory. The diſappearing of the fruits of the earth, of which Proſerpine, or Perſephone*, or Pereſephone (Y), is the emblem, is the allegorical rape of that goddeſs. She was ſeized and carried off by Pluto, ſovereign of the infernal regions. The ſeed committed to the earth in that dry ſeaſon appeared no more, and was, conſequently, ſaid to dwell under ground with Pluto. It was then that Ceres, that is, corn imported from Egypt, ſet out in queſt of her daughter. Again, when the earth recovered her priſtine fertility, the Core, or maid, was found by her mother Ceres, that is, the earth; for Iſis, among the Egyptians frequently ſignified the earth. The wanderings of Iſis in ſearch of Oſiris furniſhed the model for the peregrinations of Ceres.

§ *Herod. Lib.* 2.

‡ *Aſiatic Reſearches*, vol. i. and ii.

* *Plutarch. Iſis et Oſir.*

44 Different names of Ceres.

Ceres, the Roman name of the goddeſs of corn, was unknown to the modern Greeks. They always denominated her *Damater* (Z), which is rather an epithet than a proper name. The Greeks, who always affected to paſs for originals, we think ſuppreſſed the Egyptian name on purpoſe, to conceal the country of that deity. As a proof of the probability of this conjecture it may be obſerved, that they metamorphoſed the wanderings of Iſis in ſearch of Oſiris into the peregrinations of Ceres in queſt of Proſerpine. The Romans, who were leſs ambitious of the character of originality, retained one of her oriental names (A). Ceres, ſays Diodorus, appeared thrice in Attica during the reign of Erectheus; which ſeems to import, that fleets loaded with corn had thrice arrived in that country from Egypt during that period.

45 Contentions at Athens reſpecting Minerva and Neptune, the immediate cauſe of fixing the myſteries at Eleuſis.

Cecrops the firſt king of Attica had eſtabliſhed the worſhip of the Saitic Athena or Minerva in that region, and conſecrated his capital to that deity. Erectheus, in his turn, introduced the worſhip of Iſis or Damater, who in all appearance was the tutelar deity of Buſiris his native city. The ſubjects of Cecrops were a colony of Saites, and readily embraced the worſhip of Minerva; but the aborigines of that diſtrict being accuſtomed to a maritime, perhaps to a piratical, courſe of life, were more inclined to conſecrate their city to Neptune the god of the ſea, and to conſtitute him their guardian and protector. Cecrops by a ſtratagem ſecured the preference to Minerva his favourite divinity. Erectheus, in order to give equal importance to his patroneſs, had the addreſs to inſtitute the Eleuſinian myſteries; and to accompliſh his deſign laid hold on the opportunity above mentioned.

This appears to us the moſt probable account of the origin and inſtitution of the Eleuſinian myſteries; for which the Sicilian hiſtorian has indeed furniſhed the clue. We ſhall now proceed to detail ſome other circumſtances which attended the original inſtitution of theſe far-famed ceremonies.

46 Circumſtances attending the firſt appearance of Ceres in Attica.

The archprieſteſs who perſonated the newly imported deity was entertained by one Celeus *, who was either viceroy of that petty diſtrict of which Eleuſis was the capital, or ſome conſiderable perſonage in that city or its neighbourhood. Upon her immediate arrival, according to the fabulous relations of the Greeks, a farce was acted not altogether ſuitable to the character of a goddeſs whoſe myſteries were one day to be deemed ſo ſacred and auſtere. Theſe coarſe receptions, and other indecencies attending the firſt appearance of the goddeſs, that is, the Egyptian dame who aſſumed her character, were copied from the like unhallowed modes of behaviour practiſed on occaſion of the ſolemn proceſſions of her native country. Theſe ſcommata, or coarſe jokes, had an allegorical ſignification in Egypt; and among the moſt ancient Greeks the very ſame ſpirit was univerſally diffuſed by the oriental coloniſts who from time to time arrived and ſettled among them. In proceſs of time they abandoned the figurative and allegorical ſtyle, in conſequence of their acquaintance with philoſophy and abſtract reaſoning.

* *Apollod. Bibl. Lib.* 3. *cap.* 13.

(Y) This word ſeems to be formed of two Hebrew terms, *pheri* "fruit," and *tzaphon*, or *tzephon*, "abſcondit, recondidit."

(Z) Damater is compounded of the Chaldiac particle *da* "the," and *mater* "mother." As Iſis often ſignified the earth, the Greeks naturally adopted that title; becauſe, according to them, that element is the mother of all living. In the very ſame manner they diſcarded the word *Juno*, an original title of the moon, and ſubſtituted *Hera*, which intimates "miſtreſs or lady."

(A) According to ſome of the Latin etymologiſts, *Ceres*, or rather *Geres*, is derived from *gero* "to bear, to carry," becauſe the earth bears all things; or becauſe that element is the general fruit-bearer. But as this term came to Italy immediately from the eaſt, and not by the medium of Greece, we would rather incline to adopt an oriental etymology. The Hebrew word *cheres* ſignifies *arare* "to plow;" a name naturally applicable to the goddeſs of huſbandry.

reasoning. In the ceremonies of religion, however, the same allegorical and typical representations which had been imported from the east were retained; but the Grecian hierophants in a short time lost every idea of their latent import, and religious, moral, or physical interpretation. Accordingly, this shameful rencounter between Ceres and Banbo (B), or Jambe, was retained in the mysteries, though we think it was copied from Egypt, as was said above, where even that obscene action was probably an allegorical representation of something very different from what appeared to the Greeks.

At the same time that Ceres arrived in Attica, Bacchus likewise made his appearance in that country. He was entertained by one Icarus; whom, as a reward for his hospitality, he instructed in the art of cultivating the vine, and the method of manufacturing wine. Thus it appears that both agriculture and the art of managing the vintage were introduced into Athens much about the same time. Ceres was no other than a priestess of Isis; Bacchus was no doubt a priest of Osiris. The arrival of those two personages from Egypt, with a number of inferior priests in their train, produced a memorable revolution in Athens, both with respect to life, manners, and religion. The sacred rites of Isis, afterwards so famous under the name of the Eleusinian mysteries, date their institution from this period.

47 Ceres and Bacchus, who they were.

When this company of propaganda arrived at Eleusis, they were entertained by some of the most respectable persons who then inhabited that district. Their names, according to Clem. Alexand. were Banbo, Dysaulis, Triptolemus, Eumolpus, and Eubulus. From Eumolpus were descended a race of priests called Eumolpidæ, who figured at Athens many ages after. Triptolemus was an ox-herd, Eumolpus a shepherd, and Eubulus a swine-herd. These were the first apostles of the Eleusinian mysteries. They were instructed by the Egyptian missionaries; and they, in their turn, instructed their successors. Erechtheus, or, as some say, Pandion, countenanced the seminary, and built a small temple for its accommodation in Eleusis, a city of Attica, a few miles west from Athens, and originally one of the twelve districts into which that territory was divided. Here then we have arrived at the scene of those renowned mysteries, which for the space of near 2000 years were the pride of Athens and the wonder of the world.

48 Eleusinian mysteries divided into greater and lesser.

The mysteries were divided into the greater and lesser. The latter were celebrated at Agræ, a small town on the river Ilyssus: the former were celebrated in the month which the Athenians called Boedromion (C); the latter in the month Anthesterion (D). The lesser mysteries, according to the fabulous legends of the Greeks, were instituted in favour of the celebrated Hercules. That hero being commanded by Eurystheus to bring up Cerberus from the infernal regions, was desirous of being initiated in the Eleusinian mysteries before he engaged in that perilous undertaking. He addressed himself to Eumolpus the hierophant for that purpose. There was a law among the Eleusinians prohibiting the initiation of foreigners. The priest not daring to refuse the benefit to Hercules, who was both a friend and benefactor to the Athenians, advised the hero to get himself adopted by a native of the place, and so to elude the force of the law. He was accordingly adopted by one Pyolius, and so was initiated in the lesser mysteries, which were instituted for the first time upon that occasion. This account has all the air of a fable. The lesser mysteries were instituted by way of preparation for the greater.

49 Austerities and rites previous to initiation

The person who was to be initiated in the lesser mysteries, as well as in the greater, was obliged to practise the virtue of chastity a considerable time before his admission. Besides, he was to bind himself by the most solemn vows not to divulge any part of the mysteries. At the same time, he was, according to the original institution, to be a person of unblemished moral character. These were preliminaries indispensably necessary in order to his admission. A bull was sacrificed to Jupiter, and the hide of that animal, called by a peculiar name (Διος Κωδιον), was carefully preserved and carried to Eleusis, where it was spread under the feet of the initiated. The candidate was then purified by bathing in the river Ilyssus, by aspersions with salt water or salt, with laurel barley, and passing through the fire: all which rites were attended with incantations and other usages equally insignificant and ridiculous. Last of all, a young sow was sacrificed to Ceres; and this animal, according to the ritual, behoved to be with pigs: and before it was killed it was to be washed in Cantharus, one of the three harbours which formed the Piræus.

50 Into the lesser mysteries; of which

All these ceremonies duly performed, the candidate was carried into the hall appointed for the purpose of initiation. There he was taught the first elements of those arcana which were afterwards to be more fully and more clearly revealed in the more august mysteries of Eleusis. The pupils at Agræ were called *Mystæ*, which may intimate probationers; whereas those of Eleusis were denominated *Epoptæ*, importing that they saw as they were seen.

51 There were several stages, with long intervals between them.

The lesser mysteries were divided into several stages, and candidates were admitted to them according to their quality and capacity respectively. Those who were initiated in the lowest were obliged to wait five years before they were admitted to the greater. Those who had partaken of the second kind underwent a noviciate of three years; those who had been admitted to the third, one of two years; and those who had gone through the fourth were admitted to the greater at the end of one year; which was the shortest period of probation a candidate for that honour could legally undergo. Such was the process generally observed in administering the lesser mysteries.

With

(B) Apollod. Bib. ubi supra. Clem. Alexand. Cahod. page 17. where the story is told with very little reserve.

(C) The third month of the Athenian year, answering to our September.

(D) The eighth month, answering to our February; but Meursius makes it November.

52 None but natives of Athens originally admitted to the greater myſteries.

With reſpect to the greater myſteries, it is probable that originally none but the natives of Attica were admitted to partake of them. In proceſs of time, however, the pale was extended ſo far and wide as to comprehend all who ſpoke the Greek language. All foreigners were debarred from thoſe ſacred rites. They tell us, however, that Hercules, Bacchus, Caſtor and Pollux, Æſculapius and Hippocrates, were initiated in an extraordinary manner, from a regard to their high character and heroic exploits. All barbarians too, were excluded; yet Anacharſis the Scythian was indulged that privilege, in conſequence of his reputation for ſcience and philoſophy. All perſons guilty of manſlaughter, though even accidentally or involuntarily, all magicians, enchanters; in a word, all impious and profane perſons, were expreſsly prohibited the benefit of this pagan ſacrament. At laſt, however, the gate became wider, and crowds of people, of all nations, kindreds, and languages, provided their character was fair and irreproachable, ruſhed in by it. In proceſs of time the Athenians initiated even their infants; but this, we imagine, muſt have been a kind of luſtration or purification from which it was ſuppoſed that they derived a kind of moral ablution from vice, and were thought to be under the peculiar protection of the goddeſs.

53 Celebration laſted nine days; but

The celebration of the myſteries began on the 15th day of the month Boedromion; and, according to moſt ancient authors, laſted nine days. Meurſius has enumerated the tranſactions of each day, which are much too numerous to fall within the compaſs of this article; we muſt therefore refer our curious reader to the author juſt mentioned. Some days before the commencement of the feſtival, the præcones, or public criers, invited all the initiated, and all the pretenders to that honour, to attend the feſtival, with clean hands and a pure heart, and the knowledge of the Greek language.

54 Was performed only during the night.

On the evening of the 15th day of the month called *Boedromion* the initiations commenced. Our readers will obſerve, that all the moſt ſacred and ſolemn rites of the pagan ſuperſtition were performed during the night: they were indeed generally works of darkneſs. On this day there was a ſolemn cavalcade of Athenian matrons from Athens to Eleuſis, in carriages drawn by oxen. In this proceſſion the ladies uſed to rally one another in pretty looſe terms, in imitation, we ſuppoſe, of the Iſiac proceſſion deſcribed by Herodotus, which has been mentioned above. The moſt remarkable object in this proceſſion was the Mundus Cereris, contained in a ſmall coffer or baſket. This was carried by a ſelect company of Athenian matrons, who, from their office, were ſtyled *Camphoræ*. In this coffer were lodged the comb of Ceres, her mirror, a ſerpentine figure, ſome wheat and barley, the pudenda of the two ſexes, and perhaps ſome other articles which we have not been able to diſcover. The proceſſion ended at the temple, where this ſacred charge was depoſited with the greateſt ſolemnity.

55 The Mundus Cereris.

We have no deſcription of the temple of Eleuſis upon record. Pauſanias intended to have deſcribed it; but ſays he was diverted from his deſign by a dream ‖. Strabo informs us that the myſtic ſanctuary was as large as a theatre, and that it was built by Ictinus *. In the porche, or outer part of this temple, the candidates were crowned with garlands of flowers, which they called *himera*, or "the deſirable." They were at the ſame time dreſſed in new garments, which they continued to wear till they were quite worn out. They then waſhed their hands in a laver filled with holy water; a ceremony which intimated the purity of their hearts and hands. Before the doors were locked, one of the officers of the temple proclaimed with a loud voice a ſtern mandate, enjoining all the uninitiated to keep at a diſtance from the temple, and denouncing the moſt terrible menaces if any ſhould dare to diſturb or pry into the holy myſteries. Nor were theſe menaces without effect: for if any perſon was found to have crowded into the ſanctuary even through ignorance, he was put to death without mercy. Every precaution having been taken to ſecure ſecrecy, the initiatory ceremonies now began. But before we deſcribe theſe, we muſt lay before our readers a brief account of the miniſters and retainers of theſe ſecrets of paganiſm.

56 Dreſs of the candidates.

57 Care to keep the uninitiated at a diſtance.

‖ *Lib.* 9.

* See *Eleuſis.*

58 The hierophant.

The chief miniſter of theſe far-famed myſteries was the Hierophant. He was ſtyled *King*, and enjoyed that dignity during life, and was always by birth an Athenian. He preſided in the ſolemnity, as is evident from his title. This perſonage, as we learn from Euſebius, repreſented the Demiurgus, or Creator of the world. "Now in the myſteries of Eleuſis (ſays that father) the hierophant is dreſſed out in the figure of the demiurgus." What this demiurgus was, we learn from the ſame writer. As this whole inſtitution was copied from the Egyptians, we may reſt aſſured that the figure of the Eleuſinian Demiurgus was borrowed from the ſame quarter. "As for the ſymbols of the Egyptians (ſays he, quoting from Porphyry *), they are of the following complexion. The Demiurgus, whom the Egyptians call *Cneph*, is figured as a man of an azure colour, ſhaded with black, holding in his right hand a ſceptre and in his left a girdle, and having on his head a royal wing or feather wreathed round." Such, we imagine, was the equipment of the Eleuſinian hierophant. This perſon was likewiſe ſtyled *Prophet*. He was to be of the family of the Eumolpidæ; was obliged to make a vow of perpetual chaſtity; and even his voice, hair, and attitude, were adjuſted to the ritual.

* *Prep. Evan.*

59 The daduchus.

The next miniſter was the Daduchus, or torch-bearer; who, according to the father above quoted, was attired like the ſun. This miniſter reſembled the ſun, becauſe that luminary was deemed the viſible type of the ſupreme Demiurgus, and his vicegerent in governing and arranging the affairs of this lower world.

60 The prieſts.

The third was the perſon who officiated at the altar. He was habited like the moon. His office was to implore the favour of the gods for all the initiated. We ſhould rather imagine, that the perſon at the altar, as he reſembled the moon, was intended to repreſent the goddeſs herſelf: for the Egyptian Iſis, who was the archetype of Ceres, was ſometimes the moon and ſometimes the earth.

61 The herald.

The ſacred herald was another principal actor in this ſolemn exhibition. His province was to recite every thing that, according to the ritual, was to be communicated to the novices; and he probably repreſented Thyoth or Thoth, that is Hermes or Mercury, the interpreter of the gods.

61 The curators, &c. Besides these, there were five epimeletæ or curators, of whom the king was one, who jointly directed the whole ceremonial. Lastly, there were ten priests to offer the sacrifices. There were no doubt many officers of inferior note employed upon these occasions; but these were only insignificant appendages, whose departments have not been transmitted to posterity.

After this detail of the ministers of this solemn service, we return to the *mystæ*, or candidates for initiation. Some of the fathers of the church † mention a hymn composed by the celebrated Orpheus, which was sung by the mystagogue or king upon that occasion. This hymn appears to us one of those spurious compositions which abounded in the first ages of Chistianity, and which the pious apologists often adopted without sufficient examination. That some sacred hymn was chanted upon that occasion, we think highly probable; but that the one in question was either composed by Orpheus, or used at the opening of these ceremonies, to us appears somewhat problematical.

† *Justin. Eusob. Clem. Alex.*

Before the ceremony opened, a book was produced, which contained every thing relating to the teletæ. This was read over in the ears of the mystæ; who were ordered to write out a copy of it for themselves. This book was kept at Eleusis in a sacred repository, formed by two stones exactly fitted to each other, and of a very large size. This repository was called *petroma*. At the annual celebration of the greater mysteries, these stones were taken asunder, and the book taken out; which, after being read to the mystæ, was replaced in the same casement.

63 The petroma.

64 Commencement of the initiations. The initiations began with a representation of the wanderings of Ceres, and her bitter and loud lamentations for the loss of her beloved daughter. Upon this occasion, no doubt, a figure of that deity was displayed to the mystæ, while loud lamentations echoed from every corner of the sanctuary. One of the company having kindled a firebrand at the altar, and sprung to a certain place in the temple, waving the torch with the utmost fury, a second snatched it from him, roaring and waving it in the same frantic manner; then a third, fourth, &c. in the most rapid succession. This was done to imitate Ceres, who was said to have perlustrated the globe of the earth with a flaming pine in her hand, which she had lighted at mount Etna.

When the pageant of the goddess was supposed to arrive at Eleusis, a solemn pause ensued, and a few trifling questions were put to the mystæ: What these questions were, is evident from the answers. "I have fasted; I have drunk the liquor; I have taken the contents out of the coffer; and having performed the ceremony, have put them into the hamper: I have taken them out of the hamper, and put them again in the coffer." The meaning of these answers, we conjecture, was this: "I have fasted as Ceres fasted while in search of her daughter; I have drunk off the wort as she drank when given her by Banbo; I have performed what Ceres taught her first disciples to perform, when she committed to them the sacred hamper and coffer." After these interrogatories, and the suitable responses, the *mundus Cereris* was displayed before the eyes of the mystæ, and the *mystagogue* or hierophant, or perhaps the sacred herald by his command, read a lecture on the allegorical import of those sacred symbols. This was heard with the most profound attention; and a solemn silence prevailed throughout the fane. Such was the first act of this religious farce, which perhaps consisted originally of nothing more.

65 Questions put to the mystæ.

After the exposition of the *mundus Cereris*, and the import of her wanderings, many traditions were communicated to the mystæ concerning the origin of the universe and the nature of things. The doctrines delivered in the greater mysteries, says Clem. Alex. "relate to the nature of the universe. Here all instruction ends. Things are seen as they are; and nature, and the things of nature, are given to be comprehended. To the same purpose Cicero: "Which points being explained and reduced to the standard of reason, the nature of things, rather than that of the gods, is discovered." The Father of the universe, or the supreme demiurgus, was represented as forming the chaotic mass into the four elements, and producing animals, vegetables, and all kinds of organized beings, out of those materials. They say that they were informed of the secrets of the anomalies of the moon, and the eclipses of the sun and moon; and, according to Virgil,

66 Traditions respecting the origin of the universe, &c.

Unde hominum genus, et pecudes, unde imber et ignes.

What system of cosmogony those hierophants adopted, is evident from the passage above quoted from Eusebius; and, from the account immediately preceding, it was that of the most ancient Egyptians, and of the orientals in general. This cosmogony is beautifully and energetically exhibited in Plato's Timæus, and in the genuine spirit of poetry by Ovid in the beginning of his Metamorphoses.

The next scene exhibited upon the stage, on this solemn occasion, consisted of the exploits and adventures of the gods, demigods, and heroes, who had, from time to time, been advanced to divine honours. These were displayed as passing before the mystæ in pageants fabricated for that important purpose. This was the original mode among the Egyptians, and was no doubt followed by their Eleusinian pupils. Those adventures were probably demonstrated to have been allegorical, symbolical, hieroglyphical, &c. at least they were exhibited in such a favourable point of view as to dispel those absurdities and inconsistencies with which they were sophisticated by the poets and the vulgar.

67 Exploits of the gods, and

With respect to the origin of those factitious deities, it was discovered that they had been originally men who had been exalted to the rank of divinity, in consequence of their heroic exploits, their useful inventions, their beneficent actions, &c. This is so clear from the two passages quoted from Cicero, by bishop Warburton†, that the fact cannot be contradicted. But that prelate has not informed us so precisely, whether the mystagogues represented them as nothing more than dead men, in their present state, or as beings who were actually existing in a deified state, and executing the functions assigned them in the rubric of paganism. Another query naturally occurs, that is, to what purpose did the mystagogues apply this communication? That the hierophants did actually

68 Their origin.

† *Div. Leg.*

actually represent those deified mortals in the latter predicament, is obvious from another passage quoted from Cicero by the same prelate, which we shall transcribe as translated by him: "What think you of those who assert that valiant, or famous, or powerful men, have obtained divine honours after death; and that these are the very gods now become the objects of our worship, our prayers, and adoration? Euhemerus tells us when these gods died, and where they lie buried. I forbear to speak of the sacred and august rites of Eleusis. I pass by Samothrace and the mysteries of Lemnos, whose hidden rites are celebrated in darkness, and amidst the thick shades of groves and forests." If, then, those deified mortals were become the objects of worship and prayers, there can be no doubt of the belief of their deified existence. The allusion to the Eleusinian and other pagan mysteries towards the close of the quotation, places the question beyond the reach of controversy. But though, according to this account, "there were gods many and lords many;" yet it is evident from the passage quoted from Eusebius in the preceding part of this article, that the unity of the Supreme Being was maintained, exhibited, and inculcated. This was the original doctrine of the Hierophants of Egypt: It was maintained by Thales and all the retainers of the Ionian school. It was the doctrine of Pythagoras, who probably gleaned it up in the country just mentioned, in connection with many other dogmas which he had the assurance to claim as his own.

69 Unity of the supreme Being maintained in the mysteries.

But however the unity, and perhaps some of the most obvious attributes of the Supreme Author of nature, might be illustrated and inculcated, the tribute of homage and veneration due to the subordinate divinities was by no means neglected. The initiated were taught to look to the *dii majorum gentium* with a superior degree of awe and veneration, as beings endowed with an ineffable measure of power, wisdom, purity, goodness, &c. These were, if we may use the expression, the prime favourites of the Monarch of the universe, who were admitted into his immediate presence, and who received his behests from his own mouth, and communicated them to his subordinate officers, prefects, lieutenants, &c. These they were exhorted to adore; to them they were to offer sacrifices, prayers, and every other act of devotion, both on account of the excellency of their nature and the high rank they bore at the court of heaven. They were instructed to look up to hero-gods and demi-gods, as beings exalted to the high rank of governors of different parts of nature, as the immediate guardians and protectors of the human race; in short, as gods near at hand, as prompters to a virtuous course, and assistants in it; as ready upon all occasions to confer blessings upon the virtuous and deserving. Such were the doctrines taught in the teletæ with respect to the nature of the Pagan divinities, and the worship and devotion enjoined to be offered them by the mysteries.

70 Offices of the other gods.

71 Excellent plan for accomplishing the ends proposed in the mysteries.

As the two principal ends proposed by these initiations were the exercise of heroic virtues in men, and the practice of sincere and uniform piety by the candidates for immortal happiness, the hierophants had adopted a plan of operations excellently accommodated to both these purposes. The virtuous conduct and heroic exploits of the great men and demigods of early antiquity, were magnified by the most pompous elogiums, enforced with suitable exhortations to animate the votaries to imitate so noble and alluring an example. But this was not all: the heroes and demigods themselves were displayed in pageants, or vehicles of celestial light. Their honours, offices, habitations, attendants, and other appendages, in the capacity of demons, were exhibited with all the pomp and splendor that the sacerdotal college were able to devise. The sudden glare of mimic light, the melting music stealing upon the ear, the artificial thunders reverberated from the roof and walls of the temple, the appearance of fire and etherial radiance, the vehicles of flame, the effigies of heroes and demons adorned with crowns of laurel emitting rays from every sprig, the fragrant odours and aromatic gales which breathed from every quarter, all dexterously counterfeited by sacerdotal mechanism, must have filled the imagination of the astonished votaries with pictures at once tremendous and transporting: Add to this, that every thing was transacted in the dead of night amidst a dismal gloom; whence the most bright effulgence instantaneously burst upon the sight. By this arrangement the aspirants to initiation were wonderfully animated to the practice of virtue while they lived, and inspired with the hope of a blessed immortality when they died. At the same time, their awe and veneration for the gods of their country was wonderfully enhanced by reflecting on the appearances above described. Accordingly Strabo very judiciously observes, "that the mystical secrecy of the sacred rites preserves the majesty of the Deity, imitating its nature, which escapes our apprehension. For these reasons, in celebrating the teletæ, the demons were introduced in their deified or glorified state.

But as all the candidates for initiation might not aspire to the rank of heros and demigods, a more easy and a more attainable mode of conduct, in order to arrive at the palace of happiness, behoved to be opened. Private virtues were inculcated, and these too were to meet a condign reward. But alas! this present life is too often a chequered scene, where virtue is depressed and trodden under foot, and vice lifts up its head and rides triumphant. It is a dictate of common sense, that virtue should sooner or later emerge, and vice sink into contempt and misery. Here then the conductors of the mysteries, properly and naturally, adopted the doctrine of a future state of rewards and punishments. The dogma of the immortality of the human soul was elucidated, and carefully and pathetically inculcated. This doctrine was likewise imported from Egypt; for Herodotus‡ informs us, "that the Egyptians were the first people who maintained the immortality of the human soul." The Egyptian immortality, however, according to him, was only the metempsychosis or transmigration of souls. This was not the system of the ancient Egyptians, nor indeed of the teletæ. In these, a metempsychosis was admitted; but that was carried forward to a very distant period, to wit, to the grand Egyptian period of 36,000 years.

72 Private virtues inculcated in the mysteries, by the doctrine of a future state.

‡ *Lib.* 2.

As the mystagogues well knew that the human mind is more powerfully affected by objects presented to the eyes than by the most engaging instructions conveyed by

73 Emblems of Elysium and Tartarus. by the ear, they made the emblems of Elysium and Tartarus pass in review before the eyes of their novices. There the Elysian scenes, so nobly described by the Roman poet, appeared in mimic splendor; and, on the other hand, the gloom of Tartarus, Charon's boat, the dog of hell, the furies with tresses of snakes, the tribunal of Minos and Rhadamanthus, &c. were displayed in all their terrific state. Tantalus, Ixion, Sisyphus, the daughters of Danaus, &c. were represented in pageants before their eyes. These exhibitions were accompanied with most horrible cries and howlings, thunders, lightning, and other objects of terror, which we shall mention in their proper place.

No contrivance could be better accommodated to animate the pupils to the practice of virtue on the one hand, or to deter them from indulging vicious passions on the other. It resembled opening heaven and hell to a hardened sinner. The practices inculcated in celebrating the mysteries are too numerous to be detailed in this imperfect sketch. The worship of the gods was strictly enjoined, as has been shown above. The three laws generally ascribed to Triptolemus were inculcated, 1. To honour their parents; 2. To honour the gods with the first fruits of the earth; 3. Not to treat brute animals with cruelty. These laws were imported from Egypt, and were communicated to the Eleusinians by the original missionaries. Cicero makes the civilization of mankind one of the most beneficial effects of the Eleusinian institutions: "Nullum mihi, cum multa eximia divinaque videntur Athenæ tuæ peperisse; tum nihil melius illis mysteriis, quibus ex agresti immanique vita, exculti ad humanitatem, et mitigati sumus; initiaque, ut appellantur, ita revera principia vitæ cognovimus; neque solum cum lectitia vivendi rationem accepimus, sed etiam cum spe meliore moriendi." Hence it is evident, that the precepts of humanity and morality were warmly recommended in these institutions. The virtue of humanity was extended, one may say, even to the brute creation, as appears from the last of Triptolemus's laws above quoted. Some articles were enjoined in the teletæ which may appear to us of less importance, which, however, in the symbolical style of the Egyptians, were abundantly significant. The initiated were "commanded to abstain from the flesh of certain birds and fishes; from beans, from pomegranates and apples, which were deemed equally polluting. It was taught, that to touch the plant of asparagus was as dangerous as the most deadly poison. Now, says Porphyry, whoever is versed in the history of the *visions*, knows for what reason they were commanded to abstain from the flesh of birds."

74 The three laws of Triptolemus.

75 The initiated bound themselves by oaths to observe the precepts of the mysteries.

The initiated then bound themselves by dreadful oaths to observe most conscientiously and to practise every precept tendered to them in the course of the teletæ; and at the same time never to divulge one article of all that had been heard or seen by them upon that occasion. In this they were so exceedingly jealous, that Æschylus the tragedian was in danger of capital punishment for having only alluded to one of the Eleusinian arcana in a tragedy of his; and one of the articles of indictment against Diagoras the Melian was, his having spoken disrespectfully of the mysteries, and dissuaded people from partaking of them. It must then be allowed, that the institution of the mysteries was of infinite advantage to the pagan world. They were indeed a kind of sacraments, by which the initiated bound themselves by a solemn vow to practise piety towards the gods, justice and humanity towards their fellow-men, and gentleness and tenderness towards the inoffensive part of the brute creation. The pagans themselves were so thoroughly convinced of this fact, that in their disputes with the apologists for Christianity, they often appealed to the teletæ, and contrasted their maxims with the most sublime doctrines of that heavenly institution.

In order to impress these maxims the more deeply upon the minds of the novices, and to fix their attention more stedfastly upon the lectures which were delivered them by the mystagogue or the sacred herald, a mechanical operation was played off at proper intervals during the course of the celebration. "Towards the end of the celebration (says Stobæus), the whole scene is terrible; all is trembling, shuddering, sweat, and astonishment. Many horrible spectres are seen, and strange cries and howlings uttered. Light succeeds darkness; and again the blackest darkness the most glaring light. Now appear open plains, flowery meads, and waving groves; where are seen dances and choruses; and various holy phantasies enchant the sight. Melodious notes are heard from far, with all the sublime symphony of the sacred hymns. The pupil now is completely perfect, is initiated, becomes free, released, and walks about with a crown on his head, and is admitted to bear a part in the sacred rites." Aristides de Myst. Eleuf. calls Eleusis "a kind of temple of the whole earth, and of all that man beholds done in the most dreadful and the most exhilerating manner. In what other place have the records of fable sung of things more marvellous? or in what region upon earth have the objects presented to the eye bore a more exact resemblance to the sounds which strike the ear? What object of sight have the numberless generations of men and women beheld comparable to these exhibited in the ineffable mysteries?" To the same purpose, Pletho, in the oracles of Zoroastres, informs us, "that frightful and shocking apparitions, in a variety of forms, used to be displayed to the mystæ in the course of their initiation." And a little after, he adds, "that thunder and lightning and fire, and every thing terrible which might be held symbolical of the divine presence, was introduced." Claudian, in his poem *De Rapta Proserpina*, gives an elegant, though brief, description of this phenomenon, which throws some light on the passages above quoted.

76 Horrible spectres and pleasing scenes alternately exhibited.

" *Jam mihi cernuntur trepidis delubra moveri*
" *Sedibus et clarum dis pergere culmina lucem,*
" *Adventum testata Dea, jam magnus ab imis*
" *Auditur fremitus terris, templumque remugit*
" *Cecropidum.*"

The sight of those appearances was called the *Antopsia*, or "the real presence;" hence those rites were sometimes called *Epoptica*. The *Epoptæ* were actually initiated, and were admitted into the *Sanctum Sanctorum*, and bore a part in the ceremonial; whereas the *mystæ*, who had only been initiated in the lesser mysteries at Agræ, were obliged to take their station in the porch of

77 A kind of baptismal ablution in the mysteries.

of the temple. The candidates for initiation bathed themselves in holy water, and put on new clothes, all of linen, which they continued to wear till they were quite torn, and then they were consecrated to Ceres and Proserpine. From the ceremony of bathing they were denominated *Hydrani;* and this again was a kind of baptismal ablution. Whether the phrases of *washing away sin, putting on the Lord Jesus Christ, putting off the old man with his deeds, putting on a robe of righteousness, being buried in baptism,* the words *mystery, perfect, perfection,* which occur so frequently in the New Testament, especially in the writings of the apostle St Paul, are borrowed from the pagan mysteries, or from usages current among the Jews, we leave to our more learned readers to determine.

The Epoptæ having sustained all those fiery trials, heard and seen every thing requisite, taken upon them the vows and engagements above narrated, and, in a word, having shown themselves good soldiers of Ceres and Proserpine, were now declared *perfect men.* They might, like Cebes's *virtuous man,* travel wherever they chose: those wild beasts (the human passions) which tyrannise over the rest of mankind, and often destroy them, had no longer dominion over them. They were now not only *perfect* but *regenerated* men. They were now crowned with laurel, as was said above, and dismissed with two barbarous words, Κογξ, ὀμπαξ, *Konx ompax,* of which perhaps the Hierophants themselves did not comprehend the import. They had been introduced by the first Egyptian missionaries, and retained in the sacra after their signification was lost. This was a common practice among the Greeks. In the administration of their religious ceremonies, they retained many names of persons, places, things, customs, &c. which had been introduced by the Phœnicians and Egyptians, from whom they borrowed their system of idolatry. Those terms constituted the language of the gods, so often mentioned by the prince of poets. To us the words in question appear to be Syriac, and to signify, *Be vigilant, be innocent.*

78 The initiated declared perfect men.

Numerous and important were the advantages supposed to redound to the initiated, from their being admitted to partake of the mysteries, both in this life and that which is to come. First, they were highly honoured, and even revered, by their contemporaries. Indeed, they were looked up to as a kind of sacred persons: they were, in reality, consecrated to Ceres and Proserpine. Secondly, they were obliged by their oath to practise every virtue, religious, moral, political, public, and private. Thirdly, they imagined, that sound advice and happy measures of conduct were suggested to the initiated by the Eleusinian goddesses. Accordingly, says Pericles the celebrated Athenian statesman, "I am convinced, that the deities of Eleusis inspired me with this sentiment, and that this stratagem was suggested by the principal of the mystic rites." There is a beautiful passage in Aristophanes's* comedy of the Ranæ to the very same purpose, of which we shall subjoin the following periphrasis. It is sung by the chorus of the initiated.

* Act I.

Let us to flow'ry meads repair,
　With deathless roses blooming,
Whose balmy sweets impregn the air,
　Both hills and dales perfuming.
Since fate benign our choir has join'd,
　We'll trip in mystic measure;
In sweetest harmony combin'd
　We'll quaff full draughts of pleasure.
For us alone the pow'r of day
　A milder light dispenses;
And sheds benign a mellow'd ray
　To cheer our ravish'd senses:
For we beheld the mystic show,
　And brav'd Eleusis' dangers.
We do and know the deeds we owe
　To neighbours, friends, and strangers.

Euripides, in his Bacchæ (E), introduces the chorus extolling the happiness of those who had been acquainted with God, by participating in the holy mysteries, and whose minds had been enlightened by the mystical rites. They boast, "that they had led a holy and unblemished life, from the time that they had been initiated in the sacred rites of Jupiter Idæus, and from the time that they had relinquished celebrating the nocturnal rites of Bacchus, and the banquets of raw flesh torn off living animals." To this sanctity of life they had no doubt engaged themselves, when they were initiated in the mysteries of that god. The Eleusinian Epoptæ derived the same advantages from their sacramental engagements. Fourthly, The initiated were imagined to be the peculiar wards of the Eleusinian goddesses. These deities were supposed to watch over them, and often to avert impending danger, and to rescue them when beset with troubles.— Our readers will not imagine that the initiated reaped much benefit from the protection of his Eleusinian tutelary deities; but it was sufficient that they believed the fact, and actually depended upon their interposition. Fifthly, The happy influences of the teletæ, were supposed to administer consolation to the Epoptæ in the hour of dissolution; for, says Isocrates, "Ceres bestowed upon the Athenians two gifts of the greatest importance; the fruits of the earth, which were the cause of our no longer leading a savage course of life; and the teletæ, for they who partake of these entertain more pleasant hopes both at the end of life, and eternity afterwards." Another author * tells us, "that the initiated were not only often rescued from many hardships in their lifetime, but at death entertained hopes that they should be raised to a more happy condition." Sixthly, After death, in the Elysian fields, they were to enjoy superior degrees of felicity, and were to bask in eternal sunshine, to quaff nectar, and feast upon ambrosia, &c.

* *Aristides de Myst. El.*

79 Interestedness of the priests.

The priests were not altogether disinterested in this salutary process. They made their disciples believe, that the souls of the uninitiated, when they arrived in the infernal regions, should roll in mire and dirt, and with very great difficulty arrive at their destined mansion.

(E) Act 1. near the beginning, and in many other places.

‡ *Phædo.*

ſion. Hence Plato introduces Socrates ‡ obſerving, "that the ſages who inſtituted the teletæ had poſitively affirmed, that whatever ſoul ſhould arrive in the infernal manſions *unhouſell'd* and *unanneal'd*, ſhould lie there immerſed in mire and filth." And as to a future ſtate (ſays Ariſtides), "the initiated ſhall not roll in mire and grope in darkneſs; a fate which awaits the unholy and uninitiated." It is not hard to conceive with what a commanding influence ſuch doctrines as theſe muſt have operated on the generality of mankind.

80
Remarks of Diogenes and Antiſthenes.

When the Athenians adviſed Diogenes to get himſelf initiated, and enforced their arguments with the above conſiderations, "It will be pretty enough (replied the philoſopher) to ſee Ageſilaus and Epaminondas wallowing in the mire, while the moſt contemptible raſcals who have been initiated are ſtrutting in the iſlands of bliſs."

When Antiſthenes was to be initiated in the Orphic myſteries, and the prieſt was boaſting of the many aſtoniſhing benefits which the initiated ſhould enjoy in a future ſtate ‡, "Why, forſooth, (ſays Antiſthenes), 'tis wonder your reverence don't e'en hang yourſelf in order to come at them the ſooner."

‡ *Diog. Laert.*

81
All the world crowd to Eleuſis.

When ſuch benefits were expected to be derived from the myſteries, no wonder if all the world crowded to the Eleuſinian ſtandard. After the Macedonian conqueſts, the Hierophants abated much of their original ſtrictneſs. By the age of Cicero, Eleuſis was a temple whether all nations reſorted to partake of the benefits of that inſtitution. We find that almoſt all the great men of Rome were initiated. The Hierophants, however, would not admit Nero on account of the profligacy of his character. Few others were refuſed that honour; even the children of the Athenians were admitted. But this, we think, was rather a luſtration or conſecration, than an initiation. Perhaps it paved the way for the more auguſt ceremony, as the Chriſtian baptiſm does among us for the other ſacrament.

82
Degeneracy of the myſteries.

That this inſtitution gradually degenerated, can hardly be queſtioned; but how much, and in what points, we have not been able to inveſtigate. The fathers of the church, from whom that charge is chiefly to be collected, are not always to be truſted, eſpecially when they ſet themſelves to arraign the inſtitutions of Paganiſm. There were indeed ſeveral ancient authors, ſuch as Melanthius, Menander, Sotades, &c. who wrote purpoſely on the ſubject in queſtion; but their works are long ſince irrecoverably loſt. For this reaſon, modern writers, who have profeſſedly handled it, have not always been ſucceſsful in their reſearches. The two who have laboured moſt indefatigably, and perhaps moſt ſucceſsfully, in this field, are Meurſius and Warburton. The former, in his *Liber Singularis*, has collected every thing that can be gleaned from antiquity relating to the ceremonial of theſe inſtitutions, without, however, pointing out their original, or elucidating the end and import of their eſtabliſhment. The latter has drawn them into the vortex of a ſyſtem which has in many inſtances led him to aſcribe to them a higher degree of merit than we think they deſerve. Theſe inſtances we would willingly have noticed in our progreſs, had the limits preſcribed us admitted ſuch a diſcuſſion.

If we may believe Diodorus the Sicilian, theſe myſteries, which were celebrated with ſuch wonderful ſecrecy at Eleuſis, were communicated to all mankind among the Cretans. This, however, we think, is rather problematical. We imagine that excellent hiſtorian has confounded the myſteries of Cybele with thoſe of the Eleuſinian Ceres. Theſe two deities were undoubtedly one and the ſame, that is, the moon or the earth. Hence it is probable, that there was a ſtriking reſemblance between the ſacred myſteries of the Cretans and Eleuſinians.

This inſtitution continued in high reputation to the age of St Jerome, as appears from the following paſſage: "Hierophantæ quoque Athenienſium legant uſque hodie cicutæ ſorbitione caſtrari." The Emperor Valentinianus intended to have ſuppreſſed them; but Zozimus ‡, informs us, that he was diverted from his deſign by the proconſul of Greece. At length Theodoſius the elder, by an imperial edict prohibited the celebration of theſe as well as of all the other ſacra of Paganiſm. Theſe myſteries, inſtituted in the reign of Erectheus, mantained their ground to the period juſt mentioned, that is, near 2000 years; during which ſpace, the celebration of them never had been interrupted but once. When Alexander the Great maſſacred the Thebans and razed their city, the Athenians were ſo much affected with this melancholy event, that they neglected the celebration of that feſtival.

‡ *Adverſ. Jovin.*

83
Aboliſhed by the emperor Theodoſius.

84
Other myſteries among the pagans of leſs celebrity.

There were almoſt numberleſs other myſterious inſtitutions among the ancient Pagans, of which theſe ſketched above were the moſt celebrated. The Samothracian myſteries, inſtituted in honour of the Cabiri, were likewiſe of conſiderable celebrity, and were ſuppoſed to confer much the ſame bleſſings with the Eleuſinian, but were not of equal celebrity. The Cabiri were Phœnician and likewiſe Egyptian ‡ deities. The learned Bochart has explained their origin, number, names, and ſome part of their worſhip. The Orphic myſteries were likewiſe famous among the Thracians. Orpheus learned them in Egypt, and they were nearly the ſame with the ſacra Bacchanalia of the Greeks. There were likewiſe the myſteries of Jupiter Idæus in great requeſt among the Cretans, thoſe of the Magna Mater or Cybele, celebrated in Phrygia. To enumerate and detail all theſe would require a complete volume. We hope our readers will be fully ſatisfied with the ſpecimen exhibited above. We are convinced many things have been omitted which might have been inſerted, but we have collected the moſt curious and the moſt important.— Every one of the poſitions might have been authenticated by quotations from authors of the moſt undoubted credibility, but that proceſs would have ſwelled the article beyond all proportion.

‡ *Sanchoniathon* and *Herodotus.*

MYSTICAL,

MYSTICAL, something mysterious or allegorical. Some of the commentators on the sacred writings, besides a literal find also a mystical meaning. The sense of scripture, say they, is either that immediately signified by the words and expressions in the common use of language; or it is mediate, sublime, typical, and mystical. The literal sense they again divide into proper literal, which is contained in the words taken simply and properly; and metaphorical literal, where the words are to be taken in a figurative and metaphorical sense. The mystical sense of scripture they divide into three kinds: the first corresponding to faith, and called *allegorical;* the second to hope, called *anagogical;* and the third to charity, called the *tropological sense.* And sometimes they take the same word in scripture in all the four senses: thus the word *Jerusalem*, literally signifies the capital of Judea; allegorically, the church militant; tropologically, a believer; and anagogically, heaven. So that passage in Genesis, *let there be light, and there was light*, literally signifies corporeal light; by an allegory, the Messiah; in the tropological sense, grace; and anagogically, beatitude, or the light of glory.

MYSTICS, *mystici*, a kind of religious sect, distinguished by their professing pure, sublime, and perfect devotion, with an entire disinterested love of God, free from all selfish considerations.

The mystics, to excuse their fanatic ecstacies and amorous extravagancies, alledge that passage of St Paul, *The Spirit prays in us by sighs and groans that are unutterable.* Now if the Spirit, say they, pray in us, we must resign ourselves to its motions, and be swayed and guided by its impulse, by remaining in a state of mere inaction.

Passive contemplation is that state of perfection to which the mystics all aspire.

The authors of this mystic science, which sprung up towards the close of the third century, are not known; but the principles from which it was formed are manifest. Its first promoters proceeded from the known doctrine of the Platonic school, which was also adopted by Origen and his disciples, that the divine nature was diffused through all human souls, or that the faculty of reason, from which proceed the health and vigour of the mind, was an emanation from God into the human soul, and comprehended in it the principles and elements of all truth, human and divine. They denied that men could by labour or study excite this celestial flame in their breasts; and therefore they disapproved highly of the attempts of those, who by definitions, abstract theorems, and profound speculations, endeavoured to form distinct notions of truth, and to discover its hidden nature. On the contrary, they maintained that silence, tranquillity, repose, and solitude, accompanied with such acts as might tend to extenuate and exhaust the body, were the means by which the hidden and internal word was excited to produce its latent virtues, and to instruct men in the knowledge of divine things. For thus they reasoned; those who behold with a noble contempt all human affairs, who turn away their eyes from terrestrial vanities, and shut all the avenues of the outward senses against the contagious influences of a material world, must necessarily return to God, when the spirit is thus disengaged from the impediments that prevented that happy union. And in this blessed frame they not only enjoy inexpressible raptures from their communion with the Supreme Being, but also are invested with the inestimable privilege of contemplating truth undisguised and uncorrupted in its native purity, while others behold it in a vitiated and delusive form.

The number of the mystics increased in the fourth century, under the influence of the Grecian fanatic, who gave himself out for Dionysius the Areopagite, disciple of St Paul, and probably lived about this period; and by pretending to higher degrees of perfection than other Christians, and practising greater austerity, their cause gained ground, especially in the eastern provinces, in the fifth century. A copy of the pretended works of Dionysius was sent by Balbus to Lewis the Meek in the year 824, which kindled the holy flame of mysticism in the western provinces, and filled the Latins with the most enthusiastic admiration of this new religion.

In the twelfth century, these mystics took the lead in their method of expounding scripture; and by searching for mysteries and hidden meaning in the plainest expressions, forced the word of God into a conformity with their visionary doctrines, their enthusiastic feelings, and the system of discipline which they had drawn from the excursions of their irregular fancies. In the thirteenth century, they were the most formidable antagonists of the schoolmen; and towards the close of the fourteenth, many of them resided and propagated their tenets almost in every part of Europe. They had, in the fifteenth century, many persons of distinguished merit in their number: and in the sixteenth century, previous to the Reformation, if any sparks of real piety subsisted under the despotic empire of superstition, they were only to be found among the mystics.

The principles of this sect were adopted by those called *Quietists* in the seventeenth century, and, under different modifications, by the Quakers and Methodists.

MYSTRUM, a liquid measure among the ancients, containing the fourth part of the Cyathus, and weighing two drams and an half of oil, or two drams two scruples of water or wine. It nearly answers to our spoonful.

MYTELENE. See METYLENE.

MYTENS (Daniel), of the Hague, was an admired painter in the reigns of king James and king Charles. He had certainly (Mr Walpole says) studied the works of Rubens before his coming over. His landscape in the back grounds of his portraits is evidently in the style of that school; and some of his works have been taken for Vandyck's. The date of his arrival is not certain. At Hampton-court are several whole lengths of princes and princesses of the house of Brunswick-Lunenburgh, and the portrait of Charles Howard earl of Nottingham; at Kensington is Mytens's own head. At Knowle, Lionel Cranfield earl of Middlesex, lord treasurer, with his white staff, whole length. At Lady Elizabeth Germain's at Drayton is a very fine whole length of Henry Rich earl of Holland, in a striped habit, with a walking stick. At St James's is Jeffery Hudson the dwarf, holding a dog by a string, in a landscape, coloured warmly and freely like Snyder or Rubens. Mytens drew the same figure in a very large picture of Charles I. and his

Queen, which was in the poffeffion of the late earl of Dunmore. The picture of the Queen of Scots at St James's is a copy by Mytens. Mytens remained in great reputation till the arrival of Vandyck, who being appointed the king's principal painter, the former in difguft afked his Majefty's leave to retire to his own country; but the king learning the caufe of his diffatisfaction treated him with much kindnefs, and told him that he could find fufficient employment both for him and Vandyck. Mytens confented to ftay, and even grew intimate, it is probable, with his rival, for the head of Mytens is one of thofe painted among the profeffors by that great mafter. Whether the fame jealoufy operated again, or real decline of bufinefs influenced him, or any other caufe, Mytens did not ftay much longer in England. We find none of his works here after the year 1630. Yet he lived many years afterwards. Houbraken quotes a regifter at the Hague dated in 1656, at which time it fays Mytens painted part of the cieling of the town-hall there; the fubject is, Truth writing hiftory on the back of Fame.

MYTENS (Martin), painter of portraits and hiftory, was born at Stockholm in 1695, and at 11 years of age fhowed an extraordinary genius. When he had practifed for fome years, he determined to feek for improvement at Rome, and in his progrefs to examine every thing curious in other cities of Europe. His firft excurfion was to Holland, and from thence he proceeded to London, where he practifed miniature and enamel painting, to which he had always a ftrong tendency, and by his performances in that way gained a fufficiency to maintain himfelf, without being any incumbrance to his parents. In 1717 he vifited Paris, and proved fo fortunate as to obtain the favour of the duke of Orleans, and to have the honour to paint the portrait of that prince, and alfo the portraits of Lonis XV. and the Czar Peter. In 1721 he arrived at Vienna, where he was gracioufly received; and having with great applaufe painted the portraits of the emperor, the emprefs, and the moft illuftrious perfons at that court, during a refidence of above two years, he proceeded on his intended journey to Italy. Having vifited Venice, and fpent two years at Rome, he went to Florence, where the grand duke Gafton I. fhowed him all poffible marks of efteem; and having engaged him for fome time in his fervice, he made him confiderable prefents, and placed the portrait of Mytens among the heads of the illuftrious artifts in his gallery. He alfo received public teftimonies of favour from the king and queen of Sweden, each of them having prefented him with a chain of gold and a medal, when he vifited that court, after his return from Italy. At laft he fettled at Vienna, where he obtained large appointments from the court; and lived univerfally efteemed for his uncommon merit, and equally valued for his perfonal accomplifhments. He died in 1755.

There were fome other painters of the name of *Mytens*, but of inferior note.

MYTHOLOGY

1 Definition.

IS a term compounded of two Greek words, and in its original import it fignifies any kind of fabulous doctrine: In its more appropriated fenfe, it means thofe fabulous details concerning the objects of worfhip which were invented and propagated by men who lived in the early ages of the world, and by them tranfmitted to fucceeding generations, either by written records or by oral tradition.

As the theology and mythology of the ancients are almoft infeparably connected, it will be impoffible for us to develope the latter, without often introducing fome obfervations relating to the former. We muft therefore intreat the indulgence of our readers, if upon many occafions we fhould hazard a few ftrictures on the names, characters, adventures, and functions of fuch pagan divinities as may have furnifhed materials for thofe fabulous narrations which the nature of the fubject may lead us to difcufs.

2 Origin of fable.

With refpect to *fable*, it may be obferved in general, that it is a creature of the human imagination, and derives its birth from that love of the *marvellous* which is in a manner congenial to the foul of man.— The appearances of nature which every day occur, objects, actions, and events, which fucceed each other, by a kind of rotine, are too familiar, too obvious, and uninterefting, either to gratify curiofity or to excite admiration. On the other hand, when the moft common phenomena in nature or life are new-modelled by the plaftic power of a warm imagination; when they are diverfified, compounded, embellifhed, or even arranged and moulded into forms which feldom or perhaps never occur in the ordinary courfe of things;— novelty generates admiration, a paffion always attended with delightful fenfations. Here then we imagine we have difcovered the very fource of *fiction* and *fable*.— They originated from that powerful propenfity in our nature towards the *new* and *furprifing*, animated by the delight with which the contemplation of them is generally attended.

Many circumftances contributed to extend and eftablifh the empire of fable. The legiflator laid hold on this bias of human nature, and of courfe employed *fable* and *fiction* as the moft effectual means to civilize a rude, unpolifhed world. The philofopher, the theologift, the poet, the mufician, each in his turn, made ufe of this vehicle to convey his maxims and inftructions to the favage tribes. They knew that *truth*, fimple and unadorned, is not poffeffed of charms powerful enough to captivate the heart of man in his prefent corrupt and degenerate ftate. This confideration, which did indeed refult from the character of their audience, naturally led them to employ fiction and allegory. From this was derived the allegorical tafte of the ancients, and efpecially of the primary fages of the eaft.

Though almoft every nation on the face of the globe, however remote from the centre of population, however favage and averfe from cultivation, has fabricated and

3
Boldness of the oriental mythology.

and adopted its own syſtem of mythology; the Orientals, however, have diſtinguiſhed themſelves in a peculiar manner, by the boldneſs, the inconſiſtency, and the extravagance of their mythology. The genial warmth of thoſe happy climes, the fertility of the ſoil, which afforded every neceſſary, every conveniency, and often every luxury of life, without depreſſing their ſpirits by laborious exertions; the face of nature perpetually blooming around them, the ſkies ſmiling with uninterrupted ſerenity; all contributed to inſpire the orientals with a glow of fancy and a vigour of imagination rarely to be met with in leſs happy regions. Hence every object was ſwelled beyond its natural dimenſions. Nothing was great or little in moderation, but every ſentiment was heightened with incredible hyperbole. The magnificent, the ſublime, the vaſt, the enormous, the marvellous, firſt ſprung up, and were brought to maturity, in thoſe native regions of fable and fairyland. As nature, in the ordinary courſe of her operations, exhibited neither objects nor effects adequate to the extent of their romantic imaginations, they naturally deviated into the fields of fiction and fable. Of conſequence, the cuſtom of detailing fabulous adventures originated in the eaſt, and was from thence tranſplanted into the weſtern countries.

As the allegorical taſte of the eaſtern nations had ſprung from their propenſity to fable, and as that propenſity had in its turn originated from the love of the marvellous; ſo did allegory in proceſs of time contribute its influence towards multiplying fables and fiction almoſt *in infinitum*. The latent import of the allegorical doctrines being in a few ages loſt and obliterated, what was originally a moral or theological tenet, aſſumed the air and habit of a perſonal adventure.

4
Propenſity to perſonification a ſource of eaſtern mythology.

The propenſity towards perſonification, almoſt univerſal among the orientals, was another fruitful ſource of fable and allegory. That the people of the eaſt were ſtrongly inclined to perſonify inanimate objects and abſtract ideas, we imagine will be readily granted, when it is conſidered, that in the formation of language they have generally annexed the affection of ſex to thoſe objects. Hence the diſtinction of grammatical genders, which is known to have originated in the eaſtern parts of the world. The practice of perſonifying virtues, vices, religious and moral affections, was neceſſary to ſupport that allegorical ſtyle which univerſally prevailed in thoſe countries. This mode of writing was in high reputation even in Europe ſome centuries ago; and to it we are indebted for ſome of the moſt noble poetical compoſitions now extant in our own language. Thoſe productions, however, are but faint imitations of the original mode of writing ſtill current among the eaſtern nations. The Europeans derived this ſpecies of compoſition from the Mooriſh inhabitants of Spain, who imported it from Arabia, their original country.

5
The effects of hieroglyphic writing on mythology.

The general uſe of hieroglyphics in the eaſt, muſt have contributed largely towards extending the empire of mythology. As the import of the figures employed in this method of delineating the ſigns of ideas was in a great meaſure arbitrary, miſtakes muſt have been frequently committed in aſcertaining the notions which they were at the firſt intended to repreſent. When the developement of theſe arbitrary ſigns happened to be attended with uncommon difficulty, the expounders were obliged to have recourſe to conjecture. Thoſe conjectural expoſitions were for the moſt part tinctured with that bias towards the marvellous which univerſally prevailed among the primitive men. This we find is the caſe even at this day, when moderns attempt to develope the purport of emblematical figures, preſerved on ancient medals, entaglions, &c.

The wiſe men of the eaſt delighted in obſcure enigmatical ſentences. They ſeem to have diſdained every ſentiment obvious to vulgar apprehenſion. The words of the wiſe, and their dark ſayings, often occur in the moſt ancient records both ſacred and profane. The ſages of antiquity uſed to vie with each other for the prize of ſuperior wiſdom, by propounding riddles, and dark and myſterious queſtions, as ſubjects of inveſtigation. The conteſt between Solomon and Hiram, and that between Amaſis king of Egypt and Polycrates tyrant of Samos, are univerſally known.—As the import of thoſe enigmatical propoſitions was often abſolutely loſt, in ages when the art of writing was little known, and ſtill leſs practiſed, nothing remained but fancy and conjecture, which always verged towards the regions of fable. This then, we think, was another ſource of mythology.

6
Mythology reduced to a kind of ſyſtem in Egypt.

The Pagan prieſts, eſpecially in Egypt, were probably the firſt who reduced mythology to a kind of ſyſtem. The ſacerdotal tribe, among that people, were the grand depoſitories of learning as well as of religion. That order of men monopoliſed all the arts and ſciences. They ſeem to have formed a conſpiracy among themſelves, to preclude the laity from all the avenues of intellectual improvement. This plan was adopted with a view to keep the laity in ſubjection, and to enhance their own importance. To accompliſh this end, they contrived to perform all the miniſtrations of their religion in an unknown tongue, and to cover them with a thick veil of fable and allegory. The language of Ethiopia became their ſacred dialect, and hieroglyphics their ſacred character.—Egypt, of courſe, became a kind of fairyland, where all was jugglery, magic, and enchantment. The initiated alone were admitted to the knowledge of the occult myſtical exhibitions, which, in their hands, conſtituted the eſſence of their religion. From theſe the vulgar and profane were prohibited by the moſt rigorous penalties (ſee MYSTERIES.). The Egyptians, and indeed all the ancients without exception, deemed the myſteries of religion too ſacred and ſolemn to be communicated to the herd of mankind, naked and unreferved; a mode by which they imagined thoſe ſacred and ſublime oracles would have been defiled and degraded. "Procul, o procul eſte profani—Odi profanum vulgus et arceo." Egypt was the land of graven images; allegory and mythology were the veil which concealed religion from the eyes of the vulgar; fable was the groundwork of that impenetrable covering.

7
In the earlieſt ages of the world mythology had no exiſtence.

In the earlieſt and moſt unpoliſhed ſtage of ſociety we cannot ſuppoſe fable to have exiſted among men. Fables are always *tales of other times*, but at this period other times did not reach far enough backward to afford thoſe fruits of the imagination ſufficient time to arrive at maturity. Fable requires a conſiderable ſpace of time to acquire credibility, and to riſe into reputation. Accordingly, we find that both the Chineſe and

and Egyptians, the two moſt ancient nations whoſe annals have reached our times, were altogether unacquainted with fabulous details in the moſt early and leaſt improved periods of their reſpective monarchies. It has been ſhown almoſt to a demonſtration, by a variety of learned men, that both the one and the other people, during ſome centuries after the general deluge, retained and practiſed the primitive Noachic religion, in which fable and fancy could find no place; all was genuine unſophiſticated truth.

As ſoon as the authentic tradition concerning the origin of the univerſe was either in a good meaſure loſt, or at leaſt adulterated by the inventions of men, fable and fiction began to prevail. The Egyptian *Thoth* or Thyoth, or Mercury Triſmegiſtus, and Mo-

8 Fabulous coſmogonies, the firſt mythological details.

chus the Phœnician, undertook to account for the formation and arrangement of the univerſe, upon principles purely mechanical. Here fable began to uſurp the place of genuine hiſtorical truth. Accordingly, we find that all the hiſtorians of antiquity, who have undertaken to give a general detail of the affairs of the world, have uſhered in their narration with a fabulous coſmogony. Here imagination ranged unconfined over the boundleſs extent of the primary chaos. To be convinced of the truth of this aſſertion, we need only look into Sanchoniathon's Coſmogony, Euſeb. Præp. Evang. l. 1. ſub init. and Diodorus Sic. l. 1. From this we ſuppoſe it will follow, that the firſt race of fables owed their birth to the erroneous opinions of the formation of the univerſe.

Having now endeavoured to point out the origin of mythology, or fabulous traditions, we ſhall proceed to lay before our readers a brief detail of the mythology of the moſt reſpectable nations of antiquity, following the natural order of their ſituation.

9 Chineſe mythology.

The Chineſe, if any credit be due to their own annals, or to the miſſionaries of the church of Rome, who pretend to have copied from them, were *the firſt of the nations*. Their fabulous records reach upwards many myriads of years before the Moſaic æra of the creation. The events during that period of time, if any had been recorded, muſt have been fabulous as the period itſelf. Theſe, however, are buried in eternal oblivion. The miſſionaries, who are the only ſources of our information with relation to the earlieſt periods of the Chineſe hiſtory, repreſent thoſe people as having retained the religion of Noah many centuries after the foundation of their empire. Upon this ſuppoſition, their coſmogony muſt have been ſound and genuine, without the leaſt tincture of thoſe fabulous ingredients which have both diſguiſed and diſgraced the coſmogonies of moſt other nations.

According to the moſt authentic accounts, *Fohe* or *Fohi* laid the foundation of that empire about 4000 years ago. This emperor, according to the Chineſe, was conceived in a miraculous manner. His mo-

10 Birth and inventions of Fohi.

ther, ſay they, one day as ſhe was walking in a deſert place, was ſurrounded by a rainbow; and, being impregnated by this meteor, was in due time delivered of that celebrated legiſlator. This perſonage, like the Athenian Cecrops, was half a man and half a ſerpent. His intellectual powers were truly hyperbolical. In one day he diſcovered 50 different ſpecies of poiſonous herbs. He taught his countrymen the whole art of agriculture in the ſpace of a very few years. He inſtructed them how to ſow five different ſorts of grain. He invented boats and nets for fiſhing, the art of fabricating porcelain, the management of ſilk-worms, the manufacturing of ſilk, &c. In a word, that wonderful perſonage was inſpired by Heaven with knowledge, which qualified him for compoſing that incomparable body of laws which are even at this day the wonder of the world. Our readers will admit, that this whole detail is fabulous and chimerical. The moſt learned part of them will readily obſerve, that the Chineſe, in aſcribing the invention of all the uſeful arts to their Fohi, are perfectly agreed with almoſt all the other nations of antiquity. The Indians aſcribe every invention to *Budha*, or *Viſhnou*, or *Foe*; the Perſians to *Zerduſht* or *Zoroaſtres*; the Chaldeans to their man of the ſea, whom they call *Oannes*; the Egyptians to *Thoth* or *Thyoth*; the Phœnicians to *Melicerta*; the Greeks to the family of the *Titans*; and the Scandinavians to *Odin*, &c.

About 551 years before the Chriſtian æra, appeared the famous Chineſe philoſopher *Con-fu-tſe*, or Confucius. Concerning the birth of this prince of philoſophers, the Chineſe have propagated the following legendary tale. His mother walking in a ſolitary place was impregnated by the vivifying influence of the heavens. The babe, thus produced, ſpake and reaſoned as ſoon as it was born. Confucius, however, wrought no miracles, performed no romantic exploits, but lived an auſtere aſcetic life, taught and inculcated the doctrines of pure morality, and died, remarkable only for ſuperior wiſdom, religious, moral, and political.

11 Miraculous birth of Confucius.

12 Lao-kiun and his doctrines.

About the year of Chriſt 601, flouriſhed the Sectary *Lao-kiun*. His mother carried him 30 years in her womb, and was at laſt delivered of him under a plum-tree. This philoſopher was the Epicurus of the Chineſe. His diſciples, who were denominated *Fao-ſſe*, i. e. heavenly doctors, were the firſt who corrupted the religion of the Chineſe. They were addicted to magic, and introduced the worſhip of good and bad dæmons. Their doctrine was embraced by a long ſucceſſion of emperors. One of theſe princes, called *You-ti*, had been deprived by death of a favourite miſtreſs, whom he loved with the moſt extravagant paſſion. The emperor, by the magical ſkill of one of theſe doctors, obtained an interview with his deceaſed miſtreſs, a circumſtance which rivetted the whole order in the affection and eſteem of the deluded prince. Here our readers will obſerve the exact counterpart of the fable of Eurydice, ſo famous in the mythology of the Greeks and Romans. That ſuch a ſyſtem of religious principles muſt have abounded with mythological adventures is highly probable; but as the miſſionaries, to whom we are chiefly indebted for our information relating to the religion of the Chineſe, have not taken the pains to record them, we find it impoſſible to gratify the curioſity of our readers on that head.

13 Introduction of the worſhip of Fo, and of the doctrine of the metempſichoſis into China.

The worſhip of the idol Fo, or Foe, was tranſplanted from India into China about the 56th year of the Chriſtian æra, upon the following occaſion. One of the doctors of the Fao-ſſe had promiſed a prince of the family of Tchou, and brother of the emperor Ming-ti, to make him enter into communion with the ſpirits. At his ſolicitation an ambaſſador was diſpatched into India, in order to inquire where the true reli- gion

gion was to be found. There had been a tradition, say the missionaries, ever since the age of Confucius, that the true religion was to be found in the west.—The ambassador stopt short in India; and finding that the god Foe was in high reputation in that country, he collected several images of that deity painted on chintz, and with it 42 chapters of the canonical books of the Hindoos, which, together with the images, he laid on a white elephant, and transported into his native country. At the same time he imported from the same quarter the doctrine of the transmigration of souls, which is firmly believed in China to this day. The doctrine and worship of Foe, thus introduced, made a most rapid progress all over China, Japan, Siam, &c. The priests of Foe are called among the Siamese, *Talopoins*; by the Tartars, *Lamas*; by the Chinese, *Ho-chang*; and by the people of Japan, *Bonzes*. By this last appellation they are generally known in Europe.

14 The worshippers of Fo great mythologists.

An infinitude of fable was invented and propagated by the disciples of Foe, concerning the life and adventures of their master. If the earlier ages of the Chinese history are barren of mythological incidents, the later periods, after the introduction of the worship of Foe, furnish an inexhaustible store of miracles, monsters, fables, intrigues, exploits, and adventures, of the most villainous complexion. Indeed, most of them are so absurd, so ridiculous, and at the same time so impious and profane, that we are convinced our readers will easily dispense with a detail from which they could reap neither entertainment nor instruction. Such as may find themselves disposed to rake into this abominable puddle, we must refer to the reverend fathers du Halde, Couplet, Amiot, Kircher, and other members of the propaganda, in whose writings they will find wherewithal to satisfy, and even to surfeit, their appetite.

15 Hindoo mythology.

The Hindoos, like the other nations of the east, for a long time retained the worship of the true God. At length, however, idolatry broke in, and, like an impetuous torrent, overwhelmed the country. First of all, the genuine history of the origin of the universe was either utterly lost, or disguised under a variety of fictions and allegories. We are told that *Brimha*, the supreme divinity of the Hindoos, after three several efforts, at last succeeded in creating four persons, whom he appointed to rule over all the inferior creatures.—Afterwards Brimha joined his efficient power with Bishon and Rulder; and by their united exertions they produced ten men, whose general appellation is *Munies*, that is, the inspired. The same being, according to another mythology, produced four other persons, as imaginary as the former; one from his breast, one from his back, one from his lip, and one from his heart. These children were denominated *Bangs*; the import of which word we cannot pretend to determine. According to another tradition, Brimha produced the Bramins from his mouth, to pray, to read, to instruct; the Chiltern from his arms, to draw the bow, to fight, to govern; the Bice from his belly or thighs, to nourish, to provide the necessaries of life by agriculture and commerce; the Soder from his feet, for subjection to serve, to labour, to travel. The reader will see at once, in these allegorical persons, the four casts or septs into which the Hindoo nations has, time immemorial, been divided. These are some of their most celebrated mythological traditions with relation to the origin of the universe.

16 Hindoo traditions relating to the deluge, &c.

The Hindoos have likewise some mythological opinions which seem to relate to the general deluge. They tell us, that desiring the preservation of herds and of brahmans, of genii and of virtuous men, of *vedas* of law, and of precious things, the Lord of the universe assumes many bodily shapes; but though he pervades, like the air, a variety of beings, yet he is himself unvaried, since he has no quality in him subject to change. At the close of the last *calpa*, there was a general destruction, occasioned by the sleep of Brahme, whence his creatures in different worlds were drowned in a vast ocean. Brahme being inclined to slumber after a lapse of so many ages, the strong dæmon *Hayagri-va* came near him, and stole the *vedas* which had flowed from his lips. When *Heri*, the preserver of the universe, discovered this deed of the prince of *Dainavas*, he took the shape of a minute fish called *Sap-hari*. After various transformations, and an enormous increase of size in each of them, the Lord of the universe loving the righteous man (A), who had still adhered to him under all these various shapes, and intending to preserve him from the sea of destruction caused by the depravity of the age, thus told him how he was to act: "In seven days from the present time, O thou Tamer of enemies! the three worlds will be plunged in an ocean of death; but in the midst of the destroying waves a large vessel sent by me for thy use shall stand before thee." The remaining part of the mythology so nearly resembles the Mosaic history of Noah and the general deluge, that the former may be a strong confirmation of the truth of the latter. To dry up the waters of the deluge, the power of the Deity descends in the form of a *boar*, the symbol of strength, to draw up and support on his tusks the whole earth, which had been sunk beneath the ocean. Again, the same power is represented as a tortoise sustaining the globe, which had been convulsed by the violent assaults of dæmons, while the gods charmed the sea with the mountain *Mandar*, and forced it to disgorge the sacred things and animals, together with the water of life which it had swallowed. All these stories, we think, relate to the same event, shadowed by a moral, a metaphysical, and an astronomical allegory; and all three seem connected with the hieroglyphical sculptures of the old Egyptians.

The Hindoos divide the duration of the world into four *Yugs* or *Jugs*, or *Jogues*, each consisting of a prodigious number of years. In each of those periods, the age and stature of the human race have been gradually diminished; and in each of them mankind has gradually declined in virtue and piety, as well as in age and stature. The present period they call the *Collæ*, i. e. the corrupt Jogue, which they say is to last 400,000

(A) He was Sovereign of the world. His name was *Mana*, or Statgavrata; his patronymic name was *Vaisvata*, or Child of the Sun.

400,000 years, of which near 5000 years are already paſt. In the laſt part of the preceding Jogue, which they call the *Dwa paar*, the age of man was contracted into 1000 years, as in the preſent it is confined to 100. From this proportional diminution of the length of the human life, our readers will probably infer, that the two laſt Jogues bear a pretty near reſemblance to the Moſaic hiſtory of the age of the antediluvian and poſtdiluvian patriarchs; and that the two firſt are imaginary periods prior to the creation of the world, like thoſe of the Chineſe, Chaldeans, and Egyptians.

17 The world ſubject to various diſſolutions and reſuſcitations.

According to the mythology of the Hindoos, the ſyſtem of the world is ſubject to various diſſolutions and reſuſcitations. At the concluſion of the Collæ Jogue, ſay they, a grand revolution will take place, when the ſolar ſyſtem will be conſumed by fire, and all the elements reduced to their original conſtituent atoms. Upon the back of theſe revolutions, Brimha, the ſupreme deity of the Hindoos, is ſometimes repreſented as a new-born infant, with his toe in his mouth, floating on a camala or water flower, ſometimes only on a leaf of that plant, on the ſurface of the vaſt abyſs. At other times he is figured as coming forth of a winding ſhell; and again as blowing up the mundane foam with a pipe at his mouth. Some of theſe emblematical figures and attitudes, our learned readers will probably obſerve, nearly reſemble thoſe of the ancient Egyptians.

But the vulgar religion of the ancient Hindoos was of a very different complection, and opens a large field of mythological adventures. We have obſerved above, that the Fo or Foe of the Chineſe was imported from India; and now we ſhall give a brief detail of the mythological origin of that divinity. We have no certain account of the birth-place of this imaginary deity.—His followers relate, that he was born in one of the kingdoms of India near the line, and that his father was one of that country. His mother brought him into the world by the left ſide, and expired ſoon after her delivery. At the time of her conception, ſhe dreamed that ſhe had ſwallowed a white elephant; a circumſtance which is ſuppoſed to have given birth to the veneration which the kings of India have always ſhown for a white animal of that ſpecies. As ſoon as he was born, he had ſtrength enough to ſtand erect without aſſiſtance. He walked abroad at ſeven, and, pointing with one hand to the heavens, and with the other to the earth, he cried out, "In the heavens, and on the earth, there is no one but me who deſerves to be honoured." At the age of 30, he felt himſelf all on a ſudden filled with the divinity; and now he was metamorphoſed into Fo or Pagod, according to the expreſſion of the Hindoos. He had no ſooner declared himſelf a divinity, than he thought of propagating his doctrine, and proving his divine miſſion by miracles. The number of his diſciples was immenſe; and they ſoon ſpread his dogmas over all India, and even to the higher extremities of Aſia.

18 Birth, &c. of the god Fo.

19 Doctrines of Fo derived from Egypt.

One of the principal doctrines which Fo and his diſciples propagated, was the metempſychoſis or tranſmigration of ſouls. This doctrine, ſome imagine, has given riſe to the multitude of idols reverenced in every country where the worſhip of Fo is eſtabliſhed. Quadrupeds, birds, reptiles, and the vileſt animals, had temples erected for them; becauſe, ſay they, the ſoul of the god, in his numerous tranſmigrations, may have at one time or other inhabited their bodies.

Both the doctrine of tranſmigration and of the worſhip of animals ſeems, however, to have been imported from Egypt into India. If the intercourſe between theſe two countries was begun at ſo early a period as ſome very late writers have endeavoured to prove, ſuch a ſuppoſition is by no means improbable. The doctrine of the tranſmigration of ſouls was early eſtabliſhed among the Egyptians. It was, indeed, the only idea they formed of the ſoul's immortality. The worſhip of animals among them ſeems to have been ſtill more ancient. If ſuch an intercourſe did actually exiſt, we may naturally ſuppoſe that colonies of Egyptian prieſts found their way into India, as they did afterwards into Aſia Minor, Italy, and Greece. That colonies of Egyptians did actually penetrate into that country, and ſettle there, many centuries before the nativity, is a fact that cannot be called in queſtion, for reaſons which the bounds preſcribed us on this article will not allow us to enumerate. We ſhall only obſerve, that from the hieroglyphical repreſentations of the Egyptian deities ſeem to have originated thoſe monſtrous idols which from time immemorial have been worſhipped in India, China, Japan, Siam, and even in the remoteſt parts of Aſiatic Tartary.

20 The incarnations of Viſhnou.

Foe is often called *Budha*, *Budda*, and ſometimes *Viſhnou*; perhaps, indeed, he may be diſtinguiſhed by many other names, according to the variety of dialects of the different nations among which his worſhip was eſtabliſhed. An infinitude of fables was propagated by his diſciples concerning him after his death. They pretended that their maſter was ſtill alive; that he had been already born 8000 times; and that he had ſucceſſively appeared under the figure of an ape, a lion, a dragon, an elephant, a boar, &c. Theſe were called the incarnations of Viſhnou. At length he was confounded with the ſupreme God; and all the titles, attributes, operations, perfections, and enſigns of the Moſt High were aſcribed to him. Sometimes he is called Amida, and repreſented with the head of a dog, and worſhipped as the guardian of mankind. He ſometimes appears as a princely perſonage, iſſuing from the mouth of a fiſh. At other times, he wears a lunette on his head, in which are ſeen cities, mountains, towers, trees, in ſhort, all that the world contains. Theſe transformations are evidently the children of allegorical or hieroglyphical emblems, and form an exact counterpart to the ſymbolical worſhip of the Egyptians.

The enormous maſs of mythological traditions which have in a manner deluged the vaſt continent of India, would fill many volumes: We have ſelected the preceding articles as a ſpecimen only, by which our readers may be qualified to judge of the reſt. If they find themſelves diſpoſed to indulge their curioſity at greater length, we muſt remit them to Thevenot's and Hamilton's Travels, to Monſ. Aquetil in his Zond. Aveſta, Halhed's Introduction to his tranſlation of the Code of Gentoo Laws, Col. Dow's Hiſtory of Hindoſtan, Groſe's Voyage to the Eaſt Indies, Aſiatic Reſearches, vol. 1. and 2.

21 Perſian mythology.

The mythology of the Perſians is, if poſſible, ſtill more extravagant than that of the Hindoos. It ſuppoſes the world to have been repeatedly deſtroyed, and repeopled by creatures of different formation, who were ſucceſſively annihilated or baniſhed for their diſobedience to the ſupreme Being. The monſtrous griffin *Sinergh* tells the hero *Caherman* that ſhe had already lived to ſee the earth ſeven times filled with creatures and ſeven times a perfect void; that, before the creation of Adam, this globe was inhabited by a race of beings called *Peri* and *Dives*, whoſe character formed a perfect contraſt. The Peri are deſcribed as beautiful and benevolent; the Dives as deformed, malevolent, and miſchievous, differing from infernal demons only in this, that they are not as yet confined to the pit of hell. They are for ever ranging over the world, to ſcatter diſcord and miſery among the ſons of men. The Peri nearly reſemble the fairies of Europe; and perhaps the Dives gave birth to the giants and magicians of the middle ages. The Peri and Dives wage inceſſant wars; and when the Dives make any of the Peri priſoners, they ſhut them up in iron cages, and hang them on the higheſt trees, to expoſe them to public view, and to the fury of every chilling blaſt.

22 *Peri* and *Dives*.

When the Peri are in danger of being overpowered by their foes, they ſolicit the aſſiſtance of ſome mortal hero; which produces a ſeries of mythological adventures, highly ornamental to the ſtrains of the Perſian bards, and which, at the ſame time, furniſhes an inexhauſtible fund of the moſt diverſified machinery.

One of the moſt celebrated adventurers in the mythology of Perſia is *Tahmuras*, one of their moſt ancient monarchs. This prince performs a variety of exploits, while he endeavours to recover the fairy Merjan. He attacks the Dive Demruſh in his own cave; where, having vanquiſhed the giant or demon, he finds vaſt piles of hoarded wealth: theſe he carries off with the fair captive. The battles, labours, and adventures of Roſtan, another Perſian worthy, who lived many ages after the former, are celebrated by the Perſian bards with the ſame extravagance of hyperbole with which the labours of Hercules have been ſung by the poets of Greece and Rome.

23 Perſia the birth-place of chivalry and romance.

The adventures of the Perſian heroes breathe all the wildneſs of atchievement recorded of the knights of Gothic romance. The doctrine of enchantments, transformations, &c. exhibited in both, is a characteriſtic ſymptom of one common original. Perſia is the genuine claſſic ground of eaſtern mythology, and the ſource of the ideas of chivalry and romance; from which they were propagated to the regions of Scandinavia, and indeed to the remoteſt corners of Europe towards the weſt.

Perhaps our readers may be of our opinion, when we offer it as a conjecture, that the tales of the war of the Peri and Dives originated from a vague tradition concerning good and bad angels: nor is it, in our opinion, improbable, that the fable of the wars between the gods and giants, ſo famous in the mythology of Greece and Italy, was imported into the former of theſe countries from the ſame quarter. For a more particular account of the Perſian mythology, our readers may conſult Dr Hyde de Relig. vet. Perſ. Medor. &c. D. Herbelot's Bibl. Orient, and Mr Richardſon's introduction to his Perſian and Arabic Dictionary.

24 Chaldean mythology.

The mythology of the Chaldeans, like that of the other nations of the eaſt, commences at a period myriads of years prior to the æra of the Moſaic creation. Their coſmogony, exhibited by Beroſus, who was a prieſt of Belus, and deeply verſed in the antiquities of his country, is a piece of mythology of the moſt extravagant nature. It has been copied by Euſebius (Chron. l. i. p. 5.); it is likewiſe to be found in Syncellus, copied from Alexander Polyhiſtor. According to this hiſtorian, there were at Babylon written records preſerved with the greateſt care, comprehending a period of fifteen myriads of years. Thoſe writings likewiſe contained a hiſtory of the heavens and the ſea, of the earth, and of the origin of mankind. "In the beginning (ſays Beroſus, copying from Oannes, of whom we ſhall give a brief account below) there was nothing but darkneſs and an abyſs of water, wherein reſided moſt hideous beings produced from a twofold principle. Men appeared with two wings; ſome with two and ſome with four faces. They had one body, but two heads; the one of a man the other of a woman. Other human figures were to be ſeen, furniſhed with the legs and horns of goats. Some had the feet of horſes behind, but before were faſhioned like men, reſembling hippocentaurs." The remaining part of this mythology is much of the ſame complexion; indeed ſo extravagant, that we imagine our readers will readily enough diſpenſe with our tranſlating the ſequel. "Of all theſe (ſays the author) were preſerved delineations in the temple of Belus at Babylon. The perſon who was ſuppoſed to preſide over them was called *Omorea*. This word, in the Chaldean language, is *Thalath*, which the Greeks call θαλασσα, but it more properly imports the moon. Matters being in this ſituation, *their* god (ſays Euſebius), *the* god (ſays Syncellus) came and cut the woman aſunder; and out of one half of her he formed the earth, and out of the other he made the heavens; and, at the ſame time, he deſtroyed the monſters of the abyſs." This whole mythology is an allegorical hiſtory copied from hieroglyphical repreſentations, the real purport of which could not be decyphered by the author. Such, in general, were the conſequences of the hieroglyphical ſtyle of writing.

25 Oannes the legiſlator of the Chaldeans.

Oannes, the great civilizer and legiſlator of the Chaldeans, according to Apollodorus, who copied from Beroſus, was an amphibious animal of a heterogeneous appearance. He was endowed with reaſon and a very uncommon acuteneſs of parts. His whole body reſembled a fiſh. Under the head of a fiſh he had alſo another head, and feet below ſimilar to thoſe of a man, which were ſubjoined to the tail of the fiſh. His voice and language were articulate and perfectly intelligible, and there was a figure of him ſtill extant in the days of Beroſus. He made his appearance in the Erythrean or Red Sea, where it borders upon Babylonia. This monſtrous being converſed with men by day; but at night he plunged into the ſea, and remained concealed in the water till next morning. He taught the Babylonians the uſe of letters and the knowledge of all the arts and ſciences. He inſtructed them in the method of building houſes, conſtructing temples, and all other edifices. He taught them to compile laws

laws and religious ceremonies, and explained to them the principles of mathematics, geometry, and aftronomy. In a word, he communicated to them every thing neceffary, ufeful, and ornamental: and fo univerfal were his inftructions, that not one fingle article had ever been added to them fince the time they were firft communicated. Helladius is of opinion that this ftrange perfonage, whoever he was, came to be reprefented under the figure of a fifh, not becaufe he was actually believed to be fuch, but becaufe he was clothed with the fkin of a feal. By this account our readers will fee that the Babylonian Oannes is the exact counterpart of the Fo-hi of the Chinefe, and the Thyoth or Mercury Trifmegiftus of the Egyptians. It is likewife apparent, that the idea of the monfter compounded of the man and the fifh has originated from fome hieroglyphic of that form grafted upon the appearance of man. Some modern mythologifts have been of opinion, that Oannes was actually Noah the great preacher of righteoufnefs; who, as fome think, fettled in Shinar or Chaldea after the deluge, and who, in confequence of his connection with that event, might be properly reprefented under the emblem of *the Man of the Sea.*

26 The nativity of the goddefs of beauty and love.

The nativity of Venus, the goddefs of beauty and love, is another piece of mythology famous among the Babylonians and Affyrians. An egg, fay they, of a prodigious fize, dropt from heaven into the river Euphrates. Some doves fettled upon this egg, after that the fifhes had rolled it to the bank. In a fhort time this egg produced Venus, who was afterwards called the *Dea Syria*, the Syrian goddefs. In confequence of this tradition (fays Hyginus), pigeons and fifhes became facred to this goddefs among the Syrians, who always abftained from eating the one or the other. Of this imaginary being we have a very exact and entertaining hiftory in the treatife *De Dea Syria*, generally afcribed to Lucian.

In this mythological tradition our readers will probably difcover an allufion to the celebrated *Mundane egg;* and at the fame time the ftory of the fifhes will lead them to anticipate the connection between the fea and the moon. This fame deity was the Atargatis of Afcalon, defcribed by Diodorus the Sicilian; the one-half of her body a woman, and the other a fifh. This was no doubt a hieroglyphic figure of the moon, importing the influence of that planet upon the fea and the fex. The oriental name of this deity evidently points to the moon; for it is compounded of two Hebrew words (B), which import "the queen of the hoft of heaven."

27 The fable of Semiramis.

The fable of Semiramis is nearly connected with the preceding one. Diodorus Siculus has preferved the mythological hiftory of this deity, which he and all the writers of antiquity have confounded with the Babylonian princefs of the fame name. That hiftorian informs us, that the word *Semiramis*, in the Syrian dialect, fignifies "a wild pigeon;" but we apprehend that this term was a name or epithet of the moon, as it is compounded of two words (C) of an import naturally applicable to the lunar planet. It was a general practice among the Orientals to denominate their facred animals from that deity to which they were confecrated. Hence the moon being called *Semiramis*, and the pigeon being facred to her divinity, the latter was called by the name of the former.

As the bounds prefcribed this article renders it impoffible for us to do juftice to this interefting piece of mythology, we muft beg leave to refer our readers for farther information to Diod. Sic. l. ii. Hyginus Poet. Aftron. fab. 197. Pharnutus de Nat. Deor. Ovid. Metam. l. iv. Athen. in Apol. Izetzes Chil. ix. cap. 275. Seld. de Diis Syr. Syrit. ii. p. 183.

28 Little known of Arabian mythology.

We fhould now proceed to the mythology of the Arabians, the far greateft part of which is, however, buried in the abyfs of ages; though, when we reflect on the genius and character of that people, we muft be convinced that they too, as well as the other nations of the eaft, abounded in fabulous relations and romantic compofitions. The natives of that country have always been enthufiaftically addicted to poetry, of which fable is the effence. Wherever the mufes have erected their throne, fables and miracles have always appeared in their train. In the Koran we meet with frequent allufions to well-known traditionary fables. Thefe had been tranfmitted from generation to generation by the bards and rhapfodifts for the entertainment of the vulgar. In Arabia, from the earlieft ages, it has always been one of the favourite entertainments of the common people, to affemble in the ferene evenings around their tents, or on the platforms with which their houfes are generally covered, or in large halls erected for the purpofe, in order to amufe themfelves with traditional narrations of the moft diftinguifhed actions of their moft remote anceftors. Oriental imagery always embellifhed their romantic details. The glow of fancy, the love of the marvellous, the propenfity towards the hyperbolical, and the vaft, which conftitute the effence of oriental defcription, muft ever have drawn the relation afide into the devious regions of fiction and fairy-land. The religion of Mahomet beat down the original fabric of idolatry and mythology together. The Arabian fables current in modern times are borrowed or imitated from Perfian compofitions; Perfia being ftill the grand nurfery of romance in the eaft.

29 Egyptian mythology.

In Egypt we find idolatry, theology, and mythology, almoft infeparably blended together. The inhabitants of this region, too, as well as of others in the vicinity of the centre of population, adhered for feveral centuries to the worfhip of the true God. At laft, however, confcious of their own ignorance, impurity, imperfection, and total unfitnefs to approach an infinitely perfect Being, diftant, as they imagined, and invifible, they began to caft about for fome beings more exalted and more perfect than themfelves, by whofe mediation they might prefer their prayers to the fupreme Majefty of heaven. The luminaries of heaven, which they imagined were animated bodies, naturally prefented themfelves. Thefe were fplendid and glorious beings. They were thought to partake of the divine nature: they were revered as the fatraps, prefects,

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(B) *Adar* or *Hadar*, "*magnificus*;" and *Gad*, "*exercitus turmi.*"

(C) *Shem* or *Sem*, "a fign," and *ramah*, "high."

preſects, and repreſentatives of the ſupreme Lord of the univerſe. They were viſible, they were benefi-cent; they dwelt nearer to the gods, they were near at hand, and always acceſſible. Theſe were, of courſe, employed as mediators and interceſſors between the ſupreme Divinity and his humble ſubjects of this lower world. Thus employed, they might claim a ſubordinate ſhare of worſhip, which was accordingly aſſigned them. In proceſs of time, however, that worſhip, which was originally addreſſed to the ſupreme Creator by the mediation of the heavenly bodies, was in a great meaſure forgotten, and the adoration of mankind ultimately terminated on thoſe illuſtrious creatures. To this circumſtance, we think, we may aſcribe the origin of that ſpecies of idolatry called *Zabiiſm*, or the worſhip of the hoſt of heaven, which overſpread the world early and almoſt univerſally. In Egypt this mode of worſhip was adopted in all its moſt abſurd and moſt enthuſiaſtic forms; and at the ſame time the moſt heterogeneous mythology appeared in its train. The mythology of the ancient Egyptians was ſo various and multiform, ſo complicated and ſo myſterious, that it would require many volumes even to give a ſuperficial account of its origin and progreſs, not only in its mother country, but even in many other parts of the eaſtern and weſtern world. Beſides, the idolatry and mythology of that wonderful country are ſo cloſely connected and ſo inſeparably blended together, that it is impoſſible to deſcribe the latter without at the ſame time developing the former. We hope, therefore, our readers will not be diſappointed if, in a work of this nature, we touch only upon ſome of the leading or moſt intereſting articles of this complicated ſubject.

30
Origin of Zabiiſm.

31
Reign of gods and demigods, &c. in Egypt.

The Egyptians confounded the revolutions of the heavenly bodies with the reigns of their moſt early monarchs. Hence the incredible number of years included in the reign of their eight ſuperior gods, who, according to them, filled the Egyptian throne ſucceſſively in the moſt early periods of time. To theſe, according to their ſyſtem, ſucceeded twelve demigods, who likewiſe reigned an amazing number of years. Theſe imaginary reigns were no other than the periodical revolutions of the heavenly bodies preſerved in their almanacks, which might be carried back, and actually were carried back, at pleaſure. Hence the fabulous antiquity of that kingdom. The imaginary exploits and adventures of theſe gods and demigods furniſhed an inexhauſtible fund of mythologieal romances. To the demigods ſucceeded the kings of the cynic cycle, perſonages equally chimerical with the former. The import of this epithet has greatly perplexed critics and etymologiſts. We apprehend it is an oriental word importing *royal* dignity, elevation of rank. This appellation intimated, that the monarchs of that cycle, admitting that they actually exiſted, were more powerful and more highly revered than their ſucceſſors. After the princes of the cynic cycle comes another race, denominated *Nekyes*, a title likewiſe implying royal, ſplendid, glorious. Theſe cycles figure high in the mythological annals of the Egyptians, and have furniſhed materials for a variety of learned and ingenious diſquiſitions. The wars and adventures of Oſiris, Orus, Typhon, and other allegorical perſonages who figure in the Egyptian rubric; the wanderings of Iſis, the ſiſter and wife of Oſiris; the transformation of the gods into divers kinds of animals; their birth, education, peregrinations, and exploits;—compoſe a body of mythological fictions ſo various, ſo complicated, ſo ridiculous, and often ſo apparently abſurd, that all attempts to develope and explain them have hitherto proved unſucceſsful. All, or the greateſt part, of thoſe extravagant fables, are the offspring of hieroglyphical or allegorical emblems deviſed by the prieſts and ſages of that nation, with a view to conceal the myſteries of their religion from that claſs of men whom they ſtigmatized with the name of the uninitiated rabble.

32
Birth, exploits, and transformation of the gods.

33
Worſhip of brute animals, &c.

The worſhip of brute animals and of certain vegetables univerſal among the Egyptians, was another exuberant ſource of mythological adventures. The Egyptian prieſts, many of whom were likewiſe profound philoſophers, obſerved, or pretended to obſerve, a kind of analogy between the qualities of certain animals and vegetables, and thoſe of ſome of their ſubordinate divinities. Such animals and vegetables they adopted, and conſecrated to the deities to whom they were ſuppoſed to bear this analogical reſemblance; and in proceſs of time they conſidered them as the viſible emblems of thoſe divinities to which they were conſecrated. By theſe the vulgar addreſſed their archetypes: in the ſame manner, as in other countries, pictures and ſtatues were employed for the very ſame purpoſe. The mob, in proceſs of time, forgetting the emblematical character of thoſe brutes and vegetables, addreſſed their devotion immediately to them; and of courſe theſe became the ultimate objects of vulgar adoration.

After that theſe objects, animate or inanimate, were conſecrated as the viſible ſymbols of the deities, it ſoon became faſhionable to make uſe of their figures to repreſent thoſe deities to which they were conſecrated. This practice was the natural conſequence of the hieroglyphical ſtyle which univerſally prevailed among the ancient Egyptians. Hence Jupiter Ammon was repreſented under the figure of a ram, Apis under that of a cow, Oſiris of a bull, Pan of a goat, Thoth or Mercury of an ibis, Bubaſtis or Diana of a cat, &c. It was likewiſe a common practice among thoſe deluded people to dignify theſe objects, by giving them the names of thoſe deities which they repreſented. By this mode of dignifying theſe ſacred emblems, the veneration of the rabble was conſiderably enhanced, and the ardour of their devotion inflamed in proportion. From theſe two ſources, we think, are derived the fabulous transformations of the gods, ſo generally celebrated in the Egyptian mythology, and from it imported into Greece and Italy. In conſequence of this practice, their mythological ſyſtem was rendered at once enormous and unintelligible.

34
Mercury Triſmegiſtus the author of the Egyptian mythology.

Their Thoth, or Mercury Triſmegiſtus, was, in our opinion, the inventor of this unhappy ſyſtem. This perſonage, according to the Egyptians, was the original author of letters, geometry, aſtronomy, muſic, architecture; in a word, of all the elegant and uſeful arts, and of all the branches of ſcience and philoſophy. He it was who firſt diſcovered the analogy between the divine affections, influences, appearances, operations, and the correſponding properties, qualities, and

inſtincts

instincts of certain animals, and the propriety of dedicating particular kinds of vegetables to the service of particular deities.

The priests, whose province it was to expound the mysteries of that allegorical hieroglyphical religion, (see MYSTERIES), gradually lost all knowledge of the primary import of the symbolical characters. To supply this defect, and at the same time to veil their own ignorance, the sacerdotal instructors had recourse to fable and fiction. They heaped fable upon fable, till their religion became an accumulated chaos of mythological absurdities.

Two of the most learned and most acute of the ancient philosophers have attempted a rational explication of the latent import of the Egyptian mythology; but both have failed in the attempt; nor have the moderns, who have laboured in the same department, performed their part with much better success. Instead, therefore, of prosecuting this inexplicable subject, which would swell this article beyond all proportion, we must beg leave to refer those who are desirous of further information to the following authors, where they will find enough to gratify their curiosity, if not to inform their judgment: Herodotus, lib. ii. Diodorus Siculus, lib. i. Plut. Isis and Osiris; Jamblichus de Myst. Egypt. Horapollo Hieroglyp. Egypt. Macrob. Sat. cap. 23. among the ancients: and among the moderns, Kircher's Oedip. Voss. de orig. et prog. Idol. Mr Bryant's Analysis of Anc. Mythol. Mons. Gebelin Monde prim.; and above all, to the learned Jablonski's Panth. Egyptiorum.

35 Phœnician mythology

The elements of Phœnician mythology have been preserved by Eusebius, Præp. Evang. sub init. In the large extract which that learned father hath copied from Philo Biblius's translation of Sanchoniatho's History of Phœnicia, we are furnished with several articles of mythology. Some of these throw considerable light on several passages of the sacred history; and all of them are strictly connected with the mythology of the Greeks and Romans. There we have preserved a brief but entertaining detail of the fabulous adventures of Uranus, Cronus, Dagon, Thyoth or Mercury, probably the same with the Egyptian hero of that name. Here we find Muth or Pluto, Æphcestus or Vulcan, Æsculapius, Nereus, Poseedon or Neptune, &c. Astarte, or Venus Urania, makes a conspicuous figure in the catalogue of Phœnician worthies; Pallas or Minerva is planted on the territory of Attica; in a word, all the branches of the family of the Titans, who in after ages figured in the rubric of the Greeks, are brought upon the stage, and their exploits and adventures briefly detailed.

36 Grecian mythology derived from Egypt and Phœnicia:

By comparing this fragment with the mythology of the Atlantidæ and that of the Cretans preserved by Diodorus the Sicilian, lib. v. we think there is good reason to conclude, that the family of the Titans, the several branches of which seem to have been both the authors and objects of a great part of the Grecian idolatry, originally emigrated from Phœnicia. This conjecture will receive additional strength, when it is considered, that almost all their names recorded in the fabulous records of Greece, may be easily traced up to a Phœnician original. We agree with Herodotus, that a considerable part of the idolatry of Greece may have been borrowed from the Egyptians; at the same time, we imagine it highly probable, that the idolatry of the Egyptians and Phœnicians were, in their original constitution, nearly the same. Both systems were Sabiism, or the worship of the host of heaven. The Pelasgi, according to Herodotus, learned the names of the gods from the Egyptians; but in this conjecture he is certainly warped by his partiality for that people. Had those names been imported from Egypt, they would no doubt have bewrayed their Egyptian original; whereas, every etymologist will be convinced that every one is of Phœnician extraction.

The adventures of Jupiter, Juno, Mercury, Apollo, Diana, Mars, Minerva or Pallas, Venus, Bacchus, Ceres, Proserpine, Pluto, Neptune, and the other descendants and coadjutors of the ambitious family of the Titans, furnish by far the greatest part of the mythology of Greece. They left Phœnicia, we think, about the age of Moses; they settled in Crete, a large and fertile island; from this region they made their way into Greece, which, according to the most authentic accounts, was at that time inhabited by a race of savages. The arts and inventions which they communicated to the natives; the mysteries of religion which they inculcated; the laws, customs, polity, and good order, which they established; in short, the blessings of humanity and civilization, which they everywhere disseminated, in process of time inspired the unpolished inhabitants with a kind of divine admiration. Those ambitious mortals improved this admiration into divine homage and adoration. The greater part of that worship, which had been formerly addressed to the luminaries of heaven, was now transferred to those illustrious personages. They claimed and obtained divine honours from the deluded rabble of enthusiastic Greeks. Hence sprung an inexhaustible fund of the most inconsistent and irreconcileable fictions.

37 Hence the inconsistent fictions of the Greek poets.

The foibles and frailties of the deified mortals were transmitted to posterity, incorporated as it were with the pompous attributes of supreme divinity. Hence the heterogeneous mixture of the mighty and the mean which chequers the characters of the heroes of the Iliad and Odyssey. The Greeks adopted the oriental fables; the import of which they did not understand. These they accommodated to heroes and illustrious personages, who had figured in their own country in the earliest periods. The labours of Hercules originated in Egypt, and evidently relate to the annual progress of the sun in the zodiac, though the vain-glorious Greeks accommodated them to a hero of their own, the reputed son of Jupiter and Alcmena. The expedition of Osiris they borrowed from the Egyptians, and transferred to their Bacchus, the son of Jupiter and Semele the daughter of Cadmus. The transformation and wanderings of Io are evidently transcribed from the Egyptian romance of the travels of Isis in quest of the body of Osiris, or of the Phœnician Astarte, drawn from Sanchoniathon. *Io* or *Ioh* is in reality the Egyptian name of the moon, and Astarte was the name of the same planet among the Phœnicians. Both these fables are allegorical representations of the anomalies of the lunar planet, or perhaps of the progress of the worship of that planet in different parts of the world. The fable of the conflagration occasioned by Phaethon is clearly of oriental extraction, and alludes to an excessive drought which in the early periods

periods of time ſcorched Ethiopia and the adjacent countries. The fabulous adventures of Perſeus are ſaid to have happened in the ſame regions, and are allegorical repreſentations of the influence of the ſolar luminary; for the original Perſeus was the ſun. The rape of Proſerpine and the wanderings of Ceres; the Eleuſinian myſteries; the orgia or ſacred rites of Bacchus; the rites and worſhip of the Cabiri—were imported from Egypt and Phœnicia; but ſtrangely garbled and disfigured by the Hierophants of Greece. The gigantomachia, or war between the gods and the giants, and all the fabulous events and varieties of that war, form an exact counterpart to the battles of the Peri and Dives, celebrated in the romantic annals of Perſia.

38 The Greeks ignorant of oriental languages.

A conſiderable part of the mythology of the Greeks ſprung from their ignorance of the oriental languages. They diſdained to apply themſelves to the ſtudy of languages ſpoken by people whom, in the pride of their heart, they ſtigmatiſed with the epithet of *barbarians*. This averſion to every foreign dialect was highly detrimental to their progreſs in the ſciences. The ſame neglect or averſion has, we imagine, proved an irreparable injury to the republic of letters in all ſucceeding ages. The aoids or ſtrolling bards laid hold on thoſe oriental legends, which they ſophiſticated with their own additions and improvements, in order to accommodate them to the popular taſte. Theſe wonderful tales figured in their rhapſodical compoſitions, and were greedily ſwallowed down by the credulous vulgar. Thoſe fictions, as they rolled down, were conſtantly augmented with freſh materials, till in proceſs of time their original import was either forgotten or buried in impenetrable darkneſs. A multitude of theſe Heſiod has collected in his Theogonia, or generation of the gods, which unhappily became the religious creed of the illiterate part of the Greeks. Indeed, fable was ſo cloſely interwoven with the religion of that airy volatile people, that it ſeems to have contaminated not only their religious and moral, but even their political tenets.

39 Oracle of Dodona.

The far-famed oracle of Dodona was copied from that of Ammon of Thebes in Egypt: The oracle of Apollo at Delphos was an emanation from the ſame ſource: The celebrated Apollo Pythius of the Greeks was no other than *Ob* or *Aub* of the Egyptians, who denominated the baſiliſk or royal ſnake *Ov Cai*, becauſe it was held ſacred to the ſun. *Ob* or *Aub* is ſtill retained in the Coptic dialect, and is one of the many names or epithets of that luminary. In ſhort, the ground-work of the Grecian mythology is to be traced in the eaſt. Only a ſmall part of it was fabricated in the country; and what was imported pure and genuine was miſerably ſophiſticated by the hands through which it paſſed, in order to give it a Grecian air, and to accommodate its ſtyle to the Grecian taſte. To enlarge upon this topic would be altogether ſuperfluous, as our learned readers muſt be well acquainted with it already, and the unlearned may without much trouble or expence furniſh themſelves with books upon that ſubject.

[39] Roman mythology borrowed from Greece.

The Roman mythology was borrowed from the Greeks. That people had addicted themſelves for many centuries to the arts of war and civil polity. Science and philoſophy were either neglected or unknown. At laſt they conquered Greece, the native land of ſcience, and then "Græcia capta ferum victorem cepit arte et intulit agreſti Latio." This being the caſe, their mythology was, upon the whole, a tranſcript from that of Greece. They had indeed gleaned a few fables from the Pelaſgi and Hetruſcans, which, however, are of ſo little conſequence, that they are ſcarce worth the trouble of tranſcribing.

The mythology of the Celtic nations is in a good meaſure loſt. There may poſſibly ſtill remain ſome veſtiges of the Druidical ſuperſtition in the remoteſt parts of the Highlands and iſlands of Scotland; and perhaps in the uncivilized places of Ireland. Theſe, we preſume, would afford our readers but little entertainment, and ſtill leſs inſtruction. Inſtead therefore of giving a detail of thoſe unintereſting articles, we ſhall beg leave to refer our readers to Oſſian's Poems, and Col. Valency's Collections of Iriſh Antiquities, for ſatisfaction on that ſubject.

40 Mythology of the northern nations.

The mythology of the northern nations, *i. e.* of the Norwegians, Danes, Swedes, Icelanders, &c. are uncommonly curious and entertaining. The Edda and Voluſpa contain a complete collection of fables which have not the ſmalleſt affinity with thoſe of the Greeks and Romans. They are wholly of an oriental complexion, and ſeem almoſt congenial with the tales of the Perſians above deſcribed. The Edda was compiled in Iceland in the 13th century. It is a kind of ſyſtem of the Scandinavian mythology; and has been reckoned, and we believe juſtly, a commentary on the Voluſpa, which was the Bible of the northern nations.

41 Odin or Woden.

Odin or Othin, or Woden or Waden, was the ſupreme divinity of thoſe people. His exploits and adventures furniſh the far greateſt part of their mythological creed. That hero is ſuppoſed to have emigrated from the eaſt; but from what country or at what period is not certainly known. His atchievements are magnified beyond all credibility. He is repreſented as the god of battles, and as ſlaughtering thouſands at a blow. His palace is called *Valhal*: it is ſituated in the city of Midgard, where, according to the fable, the ſouls of heroes who had bravely fallen in battle enjoy ſupreme felicity. They ſpend the day in mimic hunting-matches, or imaginary combats. At night they aſſemble in the palace of Valhalla, where they feaſt on the moſt delicious viands, dreſſed and ſerved up by the *Valkyriæ*, virgins adorned with celeſtial charms, and fluſhed with the bloom of everlaſting youth. They ſolace themſelves with drinking mead out of the ſkulls of enemies whom they killed in their days of nature. Mead, it ſeems, was the nectar of the Scandinavian heroes.

42 The hell and devil of the Scandinavians.

Sleepner, the horſe of Odin, is celebrated along with his maſter. Hela, the hell of the Scandinavians, affords a variety of fables equally ſhocking and heterogeneous. Loke, the evil genius or devil of the northern people, nearly reſembles the Typhon of the Egyptians. Signa or Sinna is the conſort of Loke; from this name the Engliſh word *ſin* is derived. The giants Weymur, Ferbanter, Belupher, and Hellunda, perform a variety of exploits, and are exhibited in the moſt frightful attitudes. One would be tempted to imagine, that they perform the exact counterpart of the giants of the Greek and Roman mythologiſts. Inſtead of glancing at theſe ridiculous and unintereſting fables,

fables, which is all that the limits prefcribed us would permit, we fhall take the liberty to lay before our readers a brief account of the contents of the Volufpa, which is indeed the text of the Scandinavian mythology.

43 The Volufpa.

The word *Volufpa* imports, "the prophecy of Vola or Fola." This was perhaps a general name for the prophetic ladies of the north, as Sybil was appropriated to women endowed with the like faculty in the fouth. Certain it is, that the ancients generally connected madnefs with the prophetic faculty. Of this we have two celebrated examples: the one in Lycophron's Alexandra, and the other in the Sybil of the Roman Poet. The word *vola* fignifies "mad or foolifh;" whence the Englifh words *fool, foolifh, folly*. *Spa*, the latter part of the compofition, fignifies "to prophecy," and is ftill current among the common people in Scotland, in the word *Spæ*, which has nearly the fame fignification.

The Volufpa confifts of between 200 and 300 lines. The prophetefs having impofed filence on all intelligent beings, declares that fhe is about to reveal the works of the Father of nature, the actions and operations of the gods, which no mortal ever knew before herfelf. She then begins with a defcription of the chaos; and then proceeds to the formation of the world, the creation of the different fpecies of its inhabitants, giants, men, and dwarfs. She then explains the employments of the fairies or deftinies, whom the northern people call *nornies*; the functions of the deities, their moft memorable adventures, their difputes with Loke, and the vengeance that enfued. She at laft concludes with a long and indeed animated defcription of the final ftate of the univerfe, and its diffolution by a general conflagration.

In this cataftrophe, Odin and all the rabble of the pagan divinities, are to be confounded in the general ruin, no more to appear on the ftage of the univerfe. Out of the ruins of the former world, according to the Volufpa, a new one fhall fpring up, arrayed in all the bloom of celeftial beauty.

Such is the doctrine exhibited in the fabulous Volufpa. So congenial are fome of the details therein delivered, efpecially their relating to the final diffolution of the prefent fyftem, and the fucceffion of a new heaven and a new earth, that we find ourfelves ftrongly inclined to fufpect, that the original fabrication of the work was a femipagan writer, much of the fame complexion with the authors of the Sybilline oracles, and of fome other apocryphal pieces which appeared in the world during the firft ages of Chriftianity.

44 Mythology of Mexico and Peru.

In America, the only mythological countries muft be Mexico and Peru. The other parts of that large continent were originally inhabited by favages, moft of them as remote from religion as from civilization. The two vaft empires of Mexico and Peru had exifted about 400 years only before the Spanifh invafion. In neither of them was the ufe of letters underftood; and of courfe the ancient opinions of the natives relating to the origin of the univerfe, the changes which fucceeded, and every other monument of antiquity, was obliterated and loft. Clavigero has indeed enumerated a vaft canaille of fanguinary gods worfhipped by the Mexicans; but produces nothing either entertaining or interefting with refpect to their mythology. The information to be derived from any other quarter is little to be depended upon. It paffes through the hands of bigoted miffionaries or other ecclefiaftics, who were fo deeply tinctured with fanaticifm, that they viewed every action, every fentiment, every cuftom, every religious opinion and ceremony of thofe half-civilized people, through a falfe medium. They often imagined they difcovered refemblances and analogies between the rites of thofe favages and the dogmas of Chriftianity, which no where exifted but in their own heated imagination.

The only remarkable piece of mythology in the annals of the Peruvians, is the pretended extraction of Manco Cape the firft Inca of Peru, and of Mama Ocolla his confort. Thefe two illuftrious perfonages appeared firft on the banks of the lake Titiaca. They were perfons of a majeftic ftature, and clothed in decent garments. They declared themfelves to be the children of the Sun, fent by their beneficent parent, who beheld with pity the miferies of the human race, to inftruct and to reclaim them. Thus we find thefe two legiflators availed themfelves of a pretence which had often been employed in more civilized regions to the very fame purpofes. The idolatry of Peru was gentle and beneficent, that of Mexico gloomy and fanguinary. Hence we may fee, that every mode of fuperftition, where a divine revelation is not concerned, borrows its complexion from the characters of its profeffors.

In the courfe of this article, our readers will obferve, that we have not much enlarged upon the mythology of the Greeks and Romans; that fubject, we imagine to be fo univerfally known by the learned, and fo little valued by the vulgar, that a minute difcuffion of it would be altogether fuperfluous. Befides, we hope it will be remembered, that the narrownefs of the limits prefcribed us would fcarce admit of a more copious detail. We would flatter ourfelves, that in the courfe of our difquifition, we have thrown out a few reflections and obfervations, which may perhaps prove more acceptable to both defcriptions of readers.

Mytilus.

MYTILUS, the Mussel, in ichthyology; a genus of animals, belonging to the order of vermes teftacea. The animal is an afcidia: the fhell bivalve; often affixed to fome fubftance by a beard; the hinge without a tooth, marked by a longitudinal hollow line. Of thefe animals there are a great many fpecies, fome of them inhabiting the feas, others the rivers and ponds. Several of them are remarkable for the beauty of their internal fhell, and for the pearls which are fometimes found in them.

1. The edulis, or edible muffel, has a ftrong fhell, flightly incurvated on one fide, and angulated on the other.

Mytilus.

other. The end near the hinge is pointed; the other rounded. When the epidermis is taken off, it is of a deep blue colour. It is found in immenfe beds, both in deep water and above low-water mark. The fineft muffels in Britain are thofe called *Hambleton hookers*, from a village called *Hambleton* in that county. They are taken out of the fea, and placed in the river Wier, within reach of the tide, where they grow very fat and delicious. This fpecies inhabits the European and Indian feas. Between the tropics it is largeft, and fmalleft within the polar circle. It is faid to be hurtful if too often eat, or in too great quantities; and is even fometimes poifonous.

2. The modiolus, or great muffel, with a ftrong fhell, blunted at the upper end; one fide angulated near the middle; from thence dilating towards the end, which is rounded. It dwells in the Mediterranean, Indian, European, and American feas; and its flefh, which is a deep orange colour, is eatable. It is the greateft of the muffels known in Britain; being from fix to feven inches in length; it lies at great depths; often feizes the baits of ground-lines, and is taken up with the hooks.

3. The cygneus, or fwan muffel, with a thin brittle fhell, very broad and convex, marked with concentric ftriæ; attenuated towards one end, dilated towards the other; decorticated about the hinge; the colour a dull green; the length fix inches, breadth three and a half. It is an inhabitant of the European rivers, frequenting chiefly their mouths.

4. The anatinus, or duck muffel, has a fhell more oblong and lefs convex than the laft; is very brittle and femitranfparent; the fpace round the hinges like the laft; the length about five inches, breadth two. It is found in Europe in frefh waters. Both it and the cygneus are devoured by fwans and ducks; whence their names: crows alfo feed on thefe muffels, as well as on different other fhell-fifh; and it is diverting to obferve, that when the fhell is too hard for their bills, they fly with it to a great height, drop the fhell on a rock, and pick out the meat when the fhell is fractured by the fall.

5. The cryftagalli, or cock's-comb muffel, has the fhell folded or plaited as it were, fpiny, and both lips rugged. It makes its abode in the coral beds of the Indian ocean.

6. The margaritiferus, or pearl-bearing muffel, has the fhell compreffed and flat, nearly orbicular, the bafe tranfverfe, and imbricated with dentated coats. It dwells in the ocean of either India. This is the *mater perlarum* of Rumphius, or mother-of-pearl fhell. On the infide it is exquifitely polifhed, and of the whitenefs and water of pearl itfelf. It has alfo the fame luftre on the outfide after the external laminæ have been taken off by aquafortis and the lapidary's mill. Mother-of-pearl is ufed in inlaid works, and in feveral toys, as fnuff-boxes, &c.

7. The lithophagus, or ftone-eating muffel, has the fhell cylindric, the extremities both ways being rounded. It inhabits the Indian, European, and Mediterranean feas, penetrating and eating away marbles, corals, &c. The Indian fhell is fofter and nearly tough like leather, but the European is more brittle.

8. The violacea, or violet muffel, has the fhell longitudinally furrowed, the rim very obtufe, fomewhat formed like the mytilus edulis, but confiderably larger and more flattened, of a beautiful violet colour. Inhabits the fouthern ocean. There are about 50 other fpecies.

Muffels not only open and fhut their fhells at pleafure, but they have alfo a progreffive motion; they can faften themfelves where they pleafe; they refpire water like the fifhes; and fome even flutter about on its furface fo as to inhale air. If they lie in fhallow places, a fmall circular motion is feen above the heel of the fhell; and a few moments after, they caft out the water by one fingle ftroke at the other end of the fhell. The mouth is fituated near the fharp angle of the animal, and is furnifhed with four floating fringes in the fhape of muftachios, which may perhaps anfwer the purpofe of lips. The barbs which furround the edge of almoft half the muffel, are a wonderful web of hollow fibres which ferve as fins or organs of refpiration, as veffels for the circulation of the fluids, and probably, as fome philofophers fuppofe, as wedges for opening their fhells; for we obferve two large mufcles or tendons for the purpofe of fhutting them; but we in vain look for their antagonifts, or thofe which are deftined to open them. When the muffel wifhes to open itfelf, it relaxes the two mufcles or tendons, and fwells the fringes, which act as wedges and feparate the fhells. The animal fhuts up itfelf by the contraction of two thick fibrous mufcles which are fixed internally to each end of the fhells; and thefe fhells are lined all around with a membrane or epidermis, which unites them fo clofely together when they are foaked in water, that not the fmalleft drop can efcape from the mufcle. When muffels choofe to walk (A), they often contrive to raife themfelves on the fharp edge of their fhells, and put forth a flefhy fubftance fufceptible of extenfion, which ferves them as a leg to drag themfelves along, in a kind of groove or furrow which they form in the fand or mud, and which fupports the fhell on both fides. In ponds, thefe furrows are very obfervable. From the fame member or leg hang the threads

(A) The common fea or edible muffel has, from its being for the moft part found faftened to the rocks, been fuppofed by many wholly incapable of progreffive motion; but this M. Reamur has fhown to be an erroneous opinion. It is a common practice in France, at fuch feafons of the year as do not afford fun enough to make falt, to throw the common fea-muffels, which the fifhermen catch about the coafts, into the brine-pits. They have an opinion that this renders their flefh the more tender and delicate, as the rain which falls at thefe feafons makes the water of the pits much lefs falt than the common fea-water. The muffels are on this occafion thrown carelefsly in, in feveral different parts of the pits; yet, at whatever diftances they have been thrown in, the fifhermen, when they go to take them out, always find them in a clufter together; and as there is no current of water in thefe places, nor any other power of motion which can have brought the muffels together, it feems

Mytilus. threads by which the animals faften (B) themfelves to rocks or to one another.

According to the obfervations of M. Mery of the Paris Academy, and the fubfequent experiments of other naturalifts, muffels are all androgynous; and, from a peculiar generative organization, each individual is of itfelf capable of propagating its fpecies, and annually does it without the intercourfe of any other. This is altogether fingular, and different from what takes place in fnails, earth-worms, and other hydrogenous or hermaphroditical animals; for though each individual of thefe contains the parts of both fexes, yet there is always a congrefs of two animals for the propagation of the fpecies. The parts of generation are two Mytilus.

feems very evident that they muft voluntarily have marched from the places where they were at firft, to have met thus together. This progreffive motion is wholly performed by means of what we call the *tongue* of the muffel, from its fhape; but, from its ufe in this cafe, appears rather to merit the name of a *leg*, or an *arm*, as by laying hold of any diftant fubftance, and then forcibly contracting itfelf again, it draws along the whole body of the animal. The fame part, when it has moved the animal to a proper place, ferves alfo to fix it there, being the organ by which it fpins the threads which we call its *beard*, by which it is held to a rock, or to another muffel. The motion of the muffel, by means of this part, is juft the fame with that of a man laid flat on his belly, who would draw himfelf along by laying hold of any thing with one hand, and then drawing himfelf to it.

(B) Muffels are well known to have a power of faftening themfelves either to ftones, or to one another's fhells, in a very ftrong and firm manner; but the method of doing this was not well underftood till the obfervations of Mr Reaumur explained it. Every one who opens and examines a common muffel, will find, that in the middle of the fifh there is placed a little blackifh or brownifh body refembling a tongue. This in large muffels is near half an inch long, and a little more than a fixth of an inch in breadth, and is narrower at the origin than at the extremity: from the root of this tongue, or that part of it which is faftened to the body of the fifh, there are produced a great number of threads, which, when fixed to any folid fubftance, hold the muffel firmly in its place: thefe threads are ufually from an inch to two inches in length, and in thicknefs from that of a hair to that of a hog's briftle. They iffue out of the fhell in that part where it naturally opens, and fix themfelves to any thing that lies in their way, to ftones, to fragments of fhells, or, which is the moft common cafe, to the fhells of other muffels; whence it happens that there are ufually fuch large quantities of muffels found together. Thefe threads are expanded on every fide, and are ufually very numerous, 150 having been found iffuing from one fhell: they ferve the office of fo many cables; and, each pulling in its proper direction, they keep the muffel fixed againft any force that can be offered from whatever part it come. The filaments are well known to all who eat muffels, who ever carefully feparate them under the name of the *beard*; and Mr Reaumur has found, that while the animal is living in the fea, if they are all torn away by any accident, the creature has a power of fubftituting others in their room: he found, that if a quantity of muffels were detached from one another and put into a veffel of any kind, and in that plunged into the fea, they in a little time faftened themfelves both to the fides of the veffel and to one another's fhells; the extremity of each thread feemed in this cafe to ferve in the manner of a hand to feize upon any thing that it would fix to, and the other part, which was flenderer and fmaller, to do the office of an arm in conducting it.

To know the manner of the muffels performing this operation, this diligent obferver put fome muffels into a veffel in his chamber, and covered them with fea water; he there faw that they foon began to open their fhells, and each put forth that little body before defcribed by its refemblance to a tongue, and at the root of which thefe threads grow; they extended and fhortened this part feveral times, and thruft it out every way, often giving it not lefs than two inches in length, and trying before, behind, and on every fide with it, what were the proper places to fix their threads at: at the end of thefe trials they let it remain fixed for fome time on the fpot which they chofe for that purpofe, and then drawing it back into the fhell with great quicknefs, it was eafy to fee that they were then faftened by one of thefe threads to the fpot where it had before touched and remained fixed for a few minutes; and in repeating this workmanfhip the threads are increafed in number one at every time, and being fixed in different places they fuftain the fifh at reft againft any common force.

The feveral threads were found to be very different from one another; the new formed ones being ever whiter, more gloffy, and more tranfparent than the others: and it appeared on a clofe examination, that it was not, as might have been moft naturally fuppofed, the office of the tongue to convey the old threads one by one to the new places where they were now to be fixed, but that thefe in reality were now become ufelefs; and that every thread we fee now formed, is a new one made at this time; and in fine, that nature has given to fome fea-fifhes, as well as to many land-infects, a power of fpinning thofe threads for their neceffary ufes; and that muffels and the like fifh are under water, what caterpillars and fpiders are at land.—To be well affured of this, however, Mr Reaumur cut off the beard or old threads of a mufcle as clofe as he could, without injuring the part; and the proof of the opinion of their fpinning new ones at pleafure was now brought to this eafy trial, whether thefe muffels, fo deprived of their old ones, could fix themfelves as foon as others which were poffeffed of theirs, and could throw out their threads to as confiderable diftances.—The

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two ovaries and two feminal veficles. Each ovary and veficle has its proper duct. It is through thofe four channels that the eggs and the feed of the muffel are conveyed to the anus, where thofe two principles unite at their iffue, which anfwers the purpofe of generation. It is in the fpring that muffels lay their eggs; there being none found in them but in winter. M. Lewenhoek, in feveral muffels which he diffected, difcovered numbers of eggs or embryo muffels in the ovarium, appearing as plainly as if he had feen them by the naked eye, and all lying with their fharp ends faftened to the ftring of veffels by which they receive nourifhment. The minute eggs, or embryos, are by the parent placed in due order, and in a very clofe arrangement on the outfide of the fhell, where, by means of a gluey matter, they adhere very faft, and continually increafe in fize and ftrength, till becoming perfect muffels, they fall off and fhift for themfelves, leaving the holes where they were placed behind them. This abundance the muffel fhells very plainly fhow, when examined by the microfcope, and fometimes the number is 2000 or 3000 in one fhell: but it is not certain that thefe have been all fixed there by the muffel within; for thefe fifh ufually lying in great numbers near one another, the embryos of one are often affixed to the fhell of another. The fringed edge of the muffel, which Lewenhoek calls the *beard*, has in every the minuteft part of it fuch variety of motions as is inconceivable; for being compofed of longifh fibres, each fibre has on both fides a vaft many moving particles.

The muffel is infefted by feveral enemies in its own element; according to Reaumur it is in particular the prey of a fmall fhell-fifh of the trochus kind. This animal attaches itfelf to the fhell of the muffel, pierces it with a round hole, and introduces a fort of tube five or fix lines long, which it turns in a fpiral direction, and with which it fucks the fubftance of the muffel. Muffels are alfo fubject to certain difeafes, which have been fuppofed to be the caufe of thofe bad effects which fometimes happen from the eating of them. Thefe are ftated by Dr Mœhring, in the 7th vol. of the German Ephemerides, to be the mofs and the fcab. The roots of the mofs being introduced into the fhell, the water penetrates through the openings, and gradually diffolves the muffel. The fcab is formed by a fort of tubercles which are produced by the diffolution of the fhell. Certain fmall crabs, which are fometimes found in muffels, likewife tend to make them unwholefome.

The

The experiment proved the truth of the conjecture; for thofe whofe beards or old threads were cut off, fixed themfelves as foon as thofe in which they were left, and fpread their threads to as great a diftance every way.

When the mechanifm of this manufacture was thus far underftood, it became a natural defire to inquire into the nature of the part by which it was performed. This has hitherto been mentioned under the name of the tongue, from its fhape; but it is truly the arm of the fifh; and whenever it happens to be loofened from its company, or fixed in a wrong place, it ferves the animal to drag its whole body fhell and all along, and to perform its feveral motions. It fixes itfelf to fome folid body; and then ftrongly contracting its length, the whole fifh muft neceffarily follow it, and be pulled toward the place where it is fixed. This is an ufe, however, that this part is fo rarely put to, that it is not properly to be efteemed a leg or an arm for this; but, according to its more frequent employment, may much better be denominated the organ by which the threads are fpun. Though this body is flat in the manner of a tongue for the greater part of its length, it is however rounded or cylindric about the bafe or infertion, and it is much fmaller there than in any other part: there are feveral mufcular ligaments faftened to it about the root or bafe, which hold it firmly againft the middle of the back of the fhell; of thefe ligaments there are four which are particularly obfervable, and which ferve to move the body in any direction. There runs all along this body a flit or crack, which pierces very deeply into its fubftance, and divides it as it were into two longitudinal fections; this is properly a canal, and along this is thrown the liquor which ferves to form the threads; and it is in this canal or flit that thefe threads are moulded into their form. Externally, this appears only a fmall crack or flit, becaufe the two flefhy fections of the parts almoft meet and cover it; but it is rounded and deep within, and is furrounded with circular fibres. This canal is carried regularly on from the tip of the tongue, as it is called, to its bafe, where it becomes cylindric; the cylinder in this part being no other than a clofe tube or pipe, in which this open canal terminates. The cylindric tube contains a round oblong body, of the nature of the threads, except that it is much larger; and from the extremity of this all the threads are produced, this ferving as a great cable to which all the other little cordages difperfed towards different parts are fixed. The tube or pipe in which this large thread is lodged, feems the refervoir of the liquor of which the other threads are formed; all its internal furface being furnifhed with glands for its fecretion.

The muffel, like many other fea-fifhes, abounds in this liquor; and if at any time one touch with a finger the bafe of this fpinning organ, one draws away with it a vifcous liquor in form of feveral threads, like thofe of the caterpillar, fpider, and the other fpinning land-animals. The threads fix themfelves with equal eafe to the moft fmooth and gloffy, as to rougher bodies; if the muffels are kept in glafs-jars of fea-water, they as firmly faften themfelves to the glafs as to any other body. Muffels, be they ever fo young, have this property of fpinning; and by this means they faften themfelves in vaft numbers to any thing which they find in the fea. Mr Reaumur has feen them, when as fmall as millet-feeds, fpin plentifully, though their threads, proportioned to their own weight, are much finer and fmaller than thofe of larger muffels.

Mytilus.

The eating of muſſels has ſometimes produced eryſipelatous inflammations, cutaneous eruptions, inſupportable itching all over the body, great reſtleſſneſs and agitation; and though theſe complaints are eaſily removed by oil, milk, and emetics, and have ſeldom or never proved mortal, yet they have an alarming aſpect, and make the patient ſuffer grievouſly. Theſe noxious effects have been ſuppoſed to be owing to the muſſels or part of them having been diſeaſed. Some authors, however, have pretended that thoſe effects never take place but between the vernal and autumnal equinox: and M. Beunie, phyſician at Antwerp, in a memoir on this ſubject, ſeems inclined to adopt this opinion; for he recommends abſtinence from muſſels during the months of May, June, July, and Auguſt. The cauſe of theſe noxious effects in the muſſel is, according to this author, altogether accidental. They are occaſioned, he ſays, by a kind of ſtella marina, a little ſea inſect pretty common about the mouth of the Scheldt, which ſometimes lodges itſelf in the muſſel in queſt of food; and whoſe ſpawn is ſo cauſtic and inflammatory, that, even when applied outwardly to the ſkin, it produces itching and ſwellings that are painful in a high degree. The itching occaſioned by touching the ſpawn of the ſtella marina is removed by vinegar; and this known fact induced Dr Beunie to preſcribe the internal uſe of vinegar, after bleeding, evacuations, and emetics. His method conſiſts in recommending a large quantity of refreſhing beverage, and, every hour, three ounces of vinegar diluted in water. This remedy, however, ſeems rather to confirm the opinion of thoſe who impute the diſorder in queſtion to an unperceived commencement of putrefaction in the muſſel; as vinegar is known to be a powerful antiſeptic, and there is no ſort of putrefaction more noxious and offenſive than that of fiſh.—Upon the whole, the edulis, or eatable muſſel, though a rich food, is difficult of digeſtion. In its beſt ſtate it is even noxious to ſome conſtitutions; and when affected by diſeaſe is in ſome degree poiſonous. Muſſels are apt to do moſt harm when eaten raw. They ought always to be boiled with onions, well waſhed with vinegar, and ſeaſoned with pepper; and even thus qualified, they ſhould not be eaten to exceſs or too frequently.

Freſh-water muſſels are not ſo good eating as the ſea-muſſel. The river muſſel, according to M. Poupart, ſwims in the water, and ſometimes appears to flutter on its ſurface. But we believe it more commonly creeps in the mud, where it remains almoſt always at reſt. The pond muſſel is always larger than that which is found in rivers; and it is a more ſolitary animal. In its motion it makes tracks in the ſand and mud, as already obſerved; and it penetrates into it two or three inches, and ſometimes more. Pearls of conſiderable beauty are found in ſeveral river-muſſels; of this kind are the Scots muſſels, thoſe of Valognes in Lorrain, of St Savinier, of Bavaria, and of the marſhes near Augſburg.

Myttoton || Myxine.

MYTTOTON, a coarſe kind of food, uſed by the labouring people among the Greeks, and ſometimes among the Romans. It was made of garlic, onions, eggs, cheeſe, oil, and vinegar, and reckoned very wholeſome.

MYUS (anc. geog.), one of the twelve towns of Ionia; ſeated on the Meander, at the diſtance of 30 ſtadia from the ſea. In Strabo's time it was incorporated with the Mileſians, on account of the paucity of its inhabitants, from its being formerly overwhelmed with water; for which reaſon the Ionians conſigned its ſuffrage and religious ceremonies to the people of Miletus. Artaxerxes allotted this town to Themiſtocles, in order to furniſh his table with meat: Magneſia was to ſupport him in bread, and Lampſacus in wine. The town now lies in ruins.

MYXINE, the HAG; a genus of inſects belonging to the order of vermes inteſtini. It hath a ſlender body. carinated beneath; mouth at the extremity, cirrated; the two jaws pinnated; an adipoſe or rayleſs fin round the tail and under the belly. The only remarkable ſpecies is the glutinoſa, about eight inches long. It inhabits the ocean; enters the mouths of fiſh when on the hooks of lines that remain a tide under water, and totally devours the whole, except ſkin and bones. The Scarborough fiſhermen often take it in the robbed fiſh, on drawing up their lines. Linnæus attributes to it the property of turning water into glue.

N.

N, A liquid conſonant, and the 13th letter of the Greek, Latin, Engliſh, &c. alphabets.

The *n* is a naſal conſonant: its ſound is that of a *d*, paſſed through the noſe; ſo that when the noſe is ſtopped by a cold, or the like, it is uſual to pronounce *d* for *n*. M. l'Abbe de Dangeau obſerves, that in the French, the *n* is frequently a mere naſal vowel, without any thing of the conſonant in it. He calls it the Sclavonic vowel. The Hebrews call their *n nun*, which ſignifies child, as being ſuppoſed the offspring of *m*; partly on account of the reſemblance of ſound, and partly on that of the figure. Thus from the *m*, by omitting the laſt column, is formed *n*; and thus from the capital N, by omitting the firſt column, is formed the Greek minuſcle ν. Hence for *biennies*, &c. the Latins frequently uſe *bimus*, &c. and the ſame people convert the Greek ν, at the end of a word, into an *m*, as φαρμακον, *pharmacum*, &c. See M.

N before *p*, *b*, and *m*, the Latins change into *m*, and frequently into *l* and *r*; as in *in-ludo*, *illudo*; *in-riga*,

rigo, *irrigo*, &c.: in which they agree with the Hebrews, who, in lieu of *nun*, frequently double the following consonants: and the Greeks do the same; as when for *Manlius*, they write Μαλλιος, &c. The Greeks also, before κ, γ, χ, ν, changed the ν into γ: in which they were followed by the ancient Romans; who, for *Angulus*, wrote *Aggulus*; for *anceps*, *agceps*, &c.

The Latins retrench the *n* from Greek nouns ending in ων; as Λεων, *Leo*; Δρακων, *Draco*: on the contrary, the Greeks add it to the Latin ones ending in *o*; as Κατων, Νερων, *Cato*, *Nero*.

N, among the ancients, was a numeral letter, signifying 900; according to the verse in Baronius,

N, quoque nongentos numero designat habendos.

And when a line was struck over it, N̄, nine thousand. Among the ancient lawyers *N. L.* stood for *non liquet*, i. e. the cause is not clear enough to pass sentence upon. N, or N°, in commerce, &c. is used as an abbreviation of *numero*, number.

NAARDA, Nearda, *Neerda*, or *Nehardea*, (anc. geog.), a town situated on the confines of Mesopotamia and Babylonia; populous, and with a rich and extensive territory, not easily to be attacked by an enemy, being surrounded on all sides by the Euphrates and strong walls (Josephus). In the lower age the Jews had a celebrated school there.

NAAS, a borough and post town of Ireland, in the county of Kildare and province of Leinster. It is the shire town of that county, and alternately with Athy the assizes town. It is distant above 15 miles south west of Dublin, in N. Lat. 53. 10. W. Long. 6. 50. It sends two members to parliament; and gives title of viscount to the family of Burke. It has five fairs in the year.—This place was anciently the residence of the kings of Leinster: the name signifies "the place of elders," for here the states of that province assembled during the 6th, 7th, and 8th centuries, after the Naasteighan of Carmen had been anathematised by the Christian clergy. On the arrival of the English it was fortified; many castles were erected, the ruins of which are partly visible; and parliaments were held there. At the foot of the mount or rath are the ruins of a house founded in 1484, for eremites of the order of St Augustin. In the 12th century the baron of Naas founded a priory dedicated to St John the Baptist, for Augustinian regular canons. In the centre of this town the family of Eustace erected a monastery for Dominican friars, dedicated to St Eustachius; and it appears that their possessions in Naas were granted them in the year 1355. This place was a strong hold during the civil wars.

NABATENE, or Regio Nabataeorum, according to Jerome, comprised all the country lying between the Euphrates and the Red Sea, and thus contained Arabia Deserta, with a part of the Petræa: so called from Nabaioth, the first born of Ismael. According to Diodorus, it was situated between Syria and Egypt. The people Nabatæi (1 Maccabees, Diodorus Siculus); inhabiting a desart and barren country; they lived by plundering their neighbours according to Diodorus. Nabathæus the epithet.

NABIS, tyrant of Sparta, reigned about 204 B.C.; and is reported to have exceeded all other tyrants so far, that, upon comparison, he left the epithets of *gracious* and *merciful* to Dionysius and Phalaris. He is said to have contrived an instrument of torture in the form of a statue of a beautiful woman, whose rich dress concealed a number of iron spikes in her bosom and arms. When any one therefore opposed his demands, he would say, "If I have not talents enough to prevail with you, perhaps my woman Apega may persuade you." The statue then appeared; which Nabis taking by the hand, led up to the person, who, being embraced by it, was thus tortured into compliance. To render his tyranny less unpopular, Nabis made an alliance with Flaminius the Roman general, and pursued with the most inveterate enmity the war which he had undertaken against the Achæans. He besieged Gythium, and defeated Philopœmen in a naval battle. His triumph was short, the general of the Achæans soon repaired his losses, and Nabis was defeated in an engagement, and killed as he attempted to save his life by flight, about 194 years before the Christian era.

NABLOUS, a province of Syria anciently celebrated under the name of the *kingdom of Samaria*. Its capital, likewise called *Nablous*, is situated near to Sichem on the ruins of the Niepolis of the Greeks, and is the residence of a shaik, who is subordinate to the pache of Damascus, from whom he farms the tribute of the province.

NABLUM, in Hebrew, *Nebel*, was an instrument of music among the Jews. It had strings like the harp, and was played upon by both hands. Its form was that of a Greek Δ. In the Septuagint and Vulgate, it is called *nablum*, *psalterion*, *lyra*; and sometimes *cithara*.

NABO, or Nebo, in mythology, a deity of the Babylonians, who possessed the next rank to Bel. It is mentioned by Isaiah, chap. xlviii. Vossius apprehends that Nabo was the moon, and Bel the sun: but Grotius supposes that Nabo was some celebrated prophet of the country; which opinion is confirmed by the etymology of the name, signifying, according to Jerom, "one that presides over prophesy."

NABOB, properly Navab, the plural of *Naib*, a deputy. As used in Bengal, it is the same as Nazim. It is a title also given to the wives and daughters of princes, as well as to the princes themselves.

NABONASSAR, first king of the Chaldæans or Babylonians; memorable for the Jewish æra which bears his name, which is generally fixed in 3257, beginning on Wednesday February 26th in the 3967th of the Julian period, 747 years before Christ. The Babylonians revolting from the Medes, who had overthrown the Assyrian monarchy, did, under Nabonassar, found a dominion, which was much increased under Nebuchadnezzar. It is probable, that this Nabonassar is that Baladan in the second of Kings xx. 12. father of Merodach, who sent ambassadors to Hezekiah. See 2 Chron. xxxii.

NABOPOLASSAR, king of Babylon: he joined with Astyages the Mede, to destroy the empire of Assyria; which having accomplished, they founded the two empires of the Medes under Astyages, and the Chaldæans under Nabopolassar, 627 B. C.

NABUCHADNEZZAR, or Nabuchodonosor II. king of Assyria, son of Nabopolassar, and styled the *Great*, was associated by his father in the empire, 607 B. C. and the following year he took Jehoiakim king

king of Judah prifoner, and propofed to carry him and his fubjects in captivity into Babylon; but upon his fubmiffion, and promifing to hold his kingdom under Nabuchodonofor, he was permitted to remain at Jerufalem. In 603 B. C. Jehoiakim attempted to fhake off the Affyrian yoke, but without fuccefs; and this revolt brought on the general captivity. Nabuchadnezzar having fubdued the Ethiopians, Arabians, Idumæans, Philiftines, Syrians, Perfians, Medes, Affyrians, and almoft all Afia; being puffed up with pride, caufed a golden ftatue to be fet up, and commanded all to worfhip it; which Daniel's companions refufing to do, they were caft into the fiery furnace. But as he was admiring his own magnificence, by divine fentence he was driven from men, and in the fcripture ftyle is faid to have eaten grafs as oxen: i. e. he was feized with the difeafe called by the Greeks *lycanthropy*, which is a kind of madnefs that caufes perfons to run into the fields and ftreets in the night, and fometimes to fuppofe themfelves to have the heads of oxen, or to be made of glafs. At the end of feven years his reafon returned to him, and he was reftored to his throne and glory. He died 562 B. C. in the 43d year of his reign; in the 5th of which happened that eclipfe of the fun mentioned by Ptolemy, which is the fureft foundation of the chronology of his reign.

NADIR, in aftronomy, that point of the heavens which is diametrically oppofite to the zenith or point directly over our heads.

NÆNIA, the goddefs of funerals at Rome. Her temple was without the gates of the city. The fongs which were fung at funerals were alfo called *næniæ*. They were generally filled with the praifes of the deceafed; but fometimes they were fo unmeaning and improper, that the word became proverbial to fignify nonfenfe.

NAERDEN, a ftrong town of the United Provinces in Holland, feated at the head of the canals of the province. The foundations of it were laid by William of Bavaria, in 1350. It was taken by the Spaniards in 1572, and by the French in 1672; but it was retaken by the prince of Orange the next year. It ftands at the fouth end of the Zuyder Zee, in E. Long. 5. 3. N. Lat. 51. 22.

NÆVIUS (Cneius), a famous poet of Campania, was bred a foldier; but quitted the profeffion of arms, in order to apply himfelf to poetry, which he profecuted with great diligence. He compofed a hiftory in verfe, and a great number of comedies: But it is faid, that his firft performance of this laft kind fo difpleafed Metellus on account of the fatyrical ftrokes it contained, that he procured his being banifhed from the city; on which he retired to Utica in Africa, where he at length died, 202 B. C. We have only fome fragments left of his works.

There was another NÆVIUS a famous augur in the reign of Tarquin, who, to convince the ki g and the Romans of his preternatural power, cut a flint with a rafor, and turned the ridicule of the populace to admiration. Tarquin rewarded his merit by erecting him a ftatue in the comitium, which was ftill in being in the age of Auguftus. The rafor and flint were buried near it under an altar, and it was ufual among the Romans to make witneffes in civil caufes fwear near it. This miraculous event of cutting a flint with a rafor, though believed by fome writers, is treated as fabulous and improbable by Cicero, who himfelf had been an augur.

NÆVUS, a mole on the fkin, generally called a *mother's mark;* alfo the tumour known by the name of a *wen*.

All preternatural tumours on the fkin, in the form of a wart or tubercle, are called *excrefcences;* by the Greeks they are called *acrothymia;* and when they are born with a perfon, they are called *nævi materni*, or *marks from the mother*. A large tumour depending from the fkin is denominated *farcoma*. Thefe appear on any part of the body: fome of them differ not in their colour from the reft of the fkin; whilft others are red, black, &c. Their fhapes are various; fome refembling ftrawberries, others grapes, &c. Heifter advifes their removal by means of a ligature, a cautery, or a knife, as circumftances beft fuit.

As to the tumour called a *wen*, its different fpecies are diftinguifhed by their contents. They are encyfted tumours; the matter contained in the firft three following is infpiffated lymph, and that in the fourth is only fat. Monf. Littre was the firft who particularly defcribed the fourth kind; and to the following purpofe he fpeaks of them all. A wen is faid to be of three forts, according to the kind of matter it contains: thofe whofe contents refemble boiled rice, or curds, or a bread-poultice, is called *atheroma;* if it refembles honey, it is named *meliceris;* and if it is like fuet, it is denominated *fteatoma:* but there is a fourth fort, which may be called *lipome*, becaufe of its fat contents refembling greafe. He fays that he has feen one on the fhoulders of a man, which was a thin bag, of a tender texture, full of a foft fat, and that it had all the qualities of common greafe. And though the fat in the lipome refembles that in the fteatoma, yet they cannot be the fame: for the matter of the fteatoma is not inflammable, nor does it melt; or if it does, it is with great difficulty and imperfectly; whereas it is the contrary with the lipome. When the man who had the above-named lipome was fatigued, or had drank freely of ftrong liquors, his lipome was inflamed for fome days after, and its contents rarefying increafed the fize of the tumour.

The lipome feems to be no other than an enlargement of one or more of the cells of the adipofe membrane, which is filled only with its natural contents. Its foftnefs and largenefs diftinguifh it in general from the other fpecies, though fometimes the fatty contents will be fo hard as to deceive. As this kind of wen does not run between the mufcles, nor is poffeffed of any confiderable blood-veffels, it may always be cut off with eafe and fafety.

As to the other kind of wens, their extirpation may or may not be attempted, according as their fituation is with refpect to adjacent veffels, the wounding of which would endanger the patient's life.

NAGERA, or NAGARA, a town of Spain, in Old Caftile, and the territory of Rioja, with the title of a duchy and fortrefs; famous for a battle fought in its neighbourhood in 1369. It is fituated in a fertile country, on a brook called *Naferilla*. W. Long. 2. 20. N. Lat. 42. 25.

NAGRACUT, a town of India, the capital of a kingdom of the fame name in the dominions of the

Great Mogul, with a rich temple to which the Indians go in pilgrimage. It is feated on the river Ravi. E. Long. 78. 10. N. Lat. 33. 12.

NAHUM, or the *Prophecy of Nahum*, a canonical book of the Old Teftament.

Nahum, the feventh of the 12 leffer prophets, was a native of Elkofhai, a little village of Galilee. The fubject of his prophecy is the deftruction of Nineveh, which he defcribes in the moft lively and pathetic manner; his ftyle is bold and figurative, and cannot be exceeded by the moft perfect mafters of oratory. This prophecy was verified at the fiege of that city by Aftyages, in the year of the world 3378, 622 years before Chrift.

NAIADES (fab. hift.), certain inferior deities who prefided over rivers, fprings, wells, and fountains. The Naiades generally inhabited the country, and reforted to the woods or meadows near the ftream over which they prefided. They are reprefented as young and beautiful virgins, often leaning upon an urn, from which flows a ftream of water. Ægle was the faireft of the Naiades, according to Virgil. Their name feems to be derived from ναειν, *to flow*. They were held in great veneration among the ancients; and often facrifices of goats and lambs were offered to them, with libations of wine, honey, and oil. Sometimes they received only offerings of milk, fruit, and flowers.

NAIANT, in heraldry, a term ufed in blazoning fifhes, when borne in an horizontal pofture, as if fwimming.

NAIAS, in botany: A genus of the monandria order, belonging to the diœcia clafs of plants; and in the natural method ranking with thofe of which the order is doubtful. The male calyx is cylindrical and bifid; the corolla quadrifid; there is no filament; nor is there any female calyx or corolla; there is one piftil; and the capfule is ovate and unilocular.

NAID, the interior of the great defart of Arabia, inhabited by a few fcattered tribes of feeble and wretched Arabs. See Arabia.

NAIL, unguis, in anatomy. See there, n° 81.

Nails, in building, &c. fmall fpikes of iron, brafs, &c. which being drove into wood, ferve to bind feveral pieces together, or to faften fomething upon them.

Nails were made ufe of by the ancient Hebrews for cancelling bonds: and the ceremony was performed by ftriking them through the writing. This feems to be alluded to in fcripture, where God is faid by our crucified Saviour to have "blotted out the handwriting of ordinances that was againft us, and to have taken it out of the way, nailing it to his crofs." Col. ii. 14. For the caufe and ceremony of driving the annual nail, or *clavus annalis*, among the Romans, fee *Annalis Clavus*.

Nail, is alfo a meafure of length, containing the 16th part of a yard.

Nailing of Cannon. When circumftances make it neceffary to abandon cannon, or when the enemy's artillery are feized, and it is not however poffible to take them away, it is proper to nail them up, in order to render them ufelefs; which is done by driving a large nail or iron fpike into the vent of a piece of artillery, to render it unferviceable. There are various contrivances to force the nail out, as alfo fundry machines invented for that purpofe, but they have never been found of general ufe; fo that the beft method is to drill a new vent.

One Gafper Vimercalus was the firft who invented the nailing of cannon. He was a native of Bremen, and made ufe of his invention firft in nailing up the artillery of Sigifmund Malatefta.

NAIN (Lewis Sebaftian de), one of the moft learned and judicious critics and hiftorians France has produced, was the fon of a mafter of the requefts, and born at Paris in 1637. At ten years old he went to fchool at Port Royal, and became one of the beft writers of that inftitution. Sacy, his intimate friend and counfellor, prevailed with him in 1676 to receive the priefthood; which, it feems, his great humility would not before fuffer him to afpire to. This virtue he feems to have poffeffed in the extreme; fo that Boffuet, feeing one of his letters to father Dami, with whom he had fome little difpute, befought him merrily "not to be always upon his knees before his adverfary, but raife himfelf now and then up." He was folicited to pufh himfelf in the church, and Buzanval, bifhop of Beauvois, wifhed to have him for his fucceffor: but Nain, regardlefs of dignities, wifhed for nothing but retirement. In this he did indeed moft effectually bury himfelf; and, joining the mortifications of a religious life to an indefatigable purfuit of letters, he wore himfelf entirely out, fo as to die in 1698, aged 61, though he was formed for a longer life. His principal works are, 1. Memoirs on the ecclefiaftical hiftory of the fix firft ages of the church, 16 vols 4to. 2. The hiftory of the emperors, 6 vols 4to. Thefe works are deduced from original fources, and compofed with the utmoft fidelity and exactnefs.

Nain, or Naim, fituated at the bottom of mount Hermon on the north fide, was anciently a city of the tribe of Iffachar, in the province of Galilee. It was near the gates of this city that our Saviour reftored to life the only fon of a widow, and where he infpired Mary Magdalen to come and mourn for her fins at his feet. Thefe circumftances alone make this place worthy of notice; for at prefent Nain is only a hamlet inhabited by Chriftians, Mahometans, and Hebrews, where there is not a fingle monument to attract the curiofity of the traveller.

NAIRES, Nahers, or Nayers, in modern hiftory, a name which is given by the Malabarians to the military of their country, who form a very numerous clafs or tribe, out of which the fovereigns of Malabar choofe their body-guard.

NAIRN, a county of Scotland, comprehending the weft part of Murray. It is bounded on the north by Murray frith, on the weft and fouth by Invernefs, and on the eaft by Elgin. The length of it amounts to 20 miles, and the breadth to 14. The air is temperate and falubrious, and the winters are remarkably mild. The face of the country is rough and mountainous; yet there are fome fruitful ftraths, or valleys, which produce good crops of oats and barley; but in general the country is much better adapted for pafturage. Here are alfo large woods of fir, and other trees, that afford fhelter to the game, of which there is great plenty. A ftrath is a long, narrow valley, with a river running through the bottom. Of thefe, the moft remarkable

remarkable in this county, are Strathnairn, on the river of that name, in the south-west part of the shire; and on the south-east side, Stratherin, on both sides of Findhorne river. Nairn is well watered with streams, rivulets, and lakes, abounding with fish. In the southern part there is a small lake, called *Moy*, surrounding an island, on which there is a castle belonging to the laird of M'Intosh: but the greater part of the shire is peopled by the Frasers, a warlike Highland clan, whose chief, the Lord Lovat, lost his life on a scaffold for having been concerned in the late rebellion. Here are a great number of villages; but no towns of note except Nairn, supposed to be the *Tuæsis* of Ptolemy, situated at the mouth of the river which bears the same name; a royal borough, which gave a title of *lord* to an ancient family, forfeited in the rebellion of 1715. The harbour, which opened in the Murray frith, is now choaked up with sand; and the commerce of the town is too inconsiderable to deserve notice. The people in general subsist by feeding sheep and black cattle. About four miles from Nairn stands the castle of Calder, on the river of that name, belonging to a branch of the family of Campbell. In this neighbourhood we find a quarry of free-stone, and many signs of copper. About six miles to the north-west of Nairn, a new fort hath been lately built by order of the government, at a place called *Ardeseer*, a small isthmus upon the Murray frith, which it is intended to command.

NAISSANT, in heraldry, is applied to any animal issuing out of the midst of some ordinary, and showing only his head, shoulders, fore-feet, and legs, with the tip of his tail; the rest of his body being hid in the shield, or some charge upon it: in which it differs from *issuant*, which denotes a living creature arising out of the bottom of any ordinary or charge.

NAISSUS (anc. geog.), a town of Dardania, a district of Mœsia Superior, said to be the birth-place of Constantine the Great, which seems probable from his often residing at that place. *Naisitani*, the people (Coin). Now called *Nissa*, a city of Servia. E. Long. 23° N. Lat. 43°.

NAKED SEEDS, in botany, those that are not inclosed in any pod or case.

NAKIB, in the oriental dignities, the name of an officer who is a deputy to the cadiliskier, or, as he may be called, the lord high chancellor of Egypt, appointed by the grand signior. His office is to carry the standard of Mahomet.

NAKOUS, an Egyptian musical instrument, made like two plates of brass, and of all sizes, from two inches to a foot in diameter; they hold them by strings fastened to their middles, and strike them together so as to beat time. They are used in the Cophtic churches and in the Mahometan processions.

NAMA, in botany: A genus of the digynia order, belonging to the pentandria class of plants; and, in the natural method, ranking under the 13th order, *Succulentæ*. The calyx is pentaphyllous, the corolla quinquepartite, the capsule unilocular and bivalved.

NAME, denotes a word whereby men have agreed to express some idea; or which serves to denote or signify a thing or subject spoken of. See WORD.

This the grammarians usually call a *noun*, *nomen*, though their noun is not of quite so much extent as our name. See NOUN.

Seneca, Lib. II. *de Beneficiis*, observes, that there are a great number of things which have no name; and which, therefore, we are forced to call by other borrowed names. *Ingens est* (says he) *rerum copia sine nomine, quas cum propriis appellationibus signare non possumus, alienis accommodatis utimur:* which may show why, in the course of this dictionary, we frequently give divers senses to the same word.

Names are distinguished into *proper* and *appellative*.

Proper NAMES, are those which represent some individual thing or person, so as to distinguish it from all other things of the same species; as, *Socrates*, which represents a certain philosopher.

Appellative or *General* NAMES, are those which signify common ideas; or which are common to several individuals of the same species; as, *horse*, *animal*, *man*, *oak*, &c.

Proper names are either called *Christian*, as being given at baptism; or surnames: The first imposed for distinction of persons, answering to the Roman *prænomen*; the second, for the distinction of families, answering to the *nomen* of the Romans, and the *patronymicum* of the Greeks.

Originally every person had but one name; as among the Jews, *Adam*, &c. among the Egyptians, *Busiris*; among the Chaldees, *Ninus*; the Medes, *Astyages*; the Greeks, *Diomedes*; the Romans, *Romulus*; the Gauls, *Divitiacus*; the Germans, *Ariovistus*; the Britons, *Cassibelan*; the English, *Hengist*, &c. And thus of other nations, except the savages of Mount Atlas, whom Pliny and Marcellinus represent as *anonyme*, "nameless."

The Jews gave the name at the circumcision, *viz.* eight days after the birth: the Romans, to females the same day, to males the ninth; at which time they held a feast, called *nominalia*.

Since Christianity has obtained, most nations have followed the Jews, baptizing and giving the name on the eighth day after the birth; except our English ancestors, who, till of late, baptized and gave the name on the birth-day.

The first imposition of names was founded on different views, among different people; the most common was to mark the good wishes of the parents, or to entitle the children to the good fortune a happy name seemed to promise. Hence, *Victor*, *Castor*, *Faustus*, *Statorius*, *Probus*, &c.

Accordingly, we find such names, by Cicero called *bona nomina*, and by Tacitus *fausta nomina*, were first enrolled and ranged in the Roman musters; first called to serve at the sacrifices, in the foundation of colonies, &c.—And, on the contrary, Livy calls Atrius Umber, *abominandi omnis nomen*: and Plautus, on occasion of a person named *Lyco*, i. e. "greedy wolf," says;

Vosmet nunc facite conjecturam cæterum
Quid id sit hominis, cui Lyco *nomen siet.*

Hence, Plato recommends it to men to be careful in giving happy names; and the Pythagoreans taught expressly, that the minds, actions, and successes of men, were according to their names, genius, and fate. Thus

Panormitan,

Name.

Panormitan, *ex bono nomine oritur bona præſumptio*; and the common proverb, *Bonum nomen bonum omen*: and hence the foundation of the onomomantia. See ONOMOMANTIA.

It is an obſervation deſerving attention, ſays the Abbé Barthelemi, that the greater part of names found in Homer are marks of diſtinction. They were given in honour of the qualities moſt eſteemed in the heroic ages. From the word *polemos*, which ſignifies war, have been formed *Tlepolemus* and *Archeptolemus*, the names of two heroes mentioned in the Iliad. The former name ſignifies *able to ſupport*, and the latter, *able to direct, the labours of war*. By adding to the word *mache*, or *battle*, certain prepoſitions and different parts of ſpeech, which modify the ſenſe in a manner always honourable, are compoſed the names *Amphimachus*, *Antimachus*, *Promachus*, *Telemachus*. Proceeding in the ſame way with the word *honorea*, "ſtrength or intrepidity," they formed the names *Agapenor*, "he who eſteems valour;" *Agenor*, "he who directs it." From *thoes*, "ſwift," are derived, *Alcathoes*, *Panthoes*, *Perithoes*, &c. From *nous*, "mind or intelligence," come *Aſtynoes*, *Arſinoes*, *Autenoes*, &c. From *medes*, "counſel," *Agamedes*, *Eumedes*, *Lycomedes*, *Thraſymedes*; and from *clios*, "glory," *Amphicles*, *Agacles*, *Iphicles*, *Patroclus*, *Cleobulus*, with many others.

Hence Camden takes it for granted, that the names, in all nations and languages, are ſignificative, and not ſimple ſounds for mere diſtinction ſake. This holds not only among the Jews, Greeks, Latins, &c. but even the Turks; among whom, Abdalla ſignifies *God's ſervant*; Soliman, *peaceable*; Mahomet, *glorified*, &c. And the ſavages of Hiſpaniola, and throughout America, who, in their languages, name their children, *Gliſtering Light*, *Sun Bright*, *Fine Gold*, *&c.*; and they of Congo, by the names of precious ſtones, flowers, &c.

To ſuppoſe names given without any meaning, however by the alteration of languages their ſignification may be loſt, that learned author thinks is to reproach our anceſtors; and that contrary to the ſenſe of all ancient writers. Porphyry notes, that the barbarous *names*, as he calls them, were very emphatical, and very conciſe: and accordingly it was eſteemed a duty to be φερωνυμοι, or *ſui nominis homines*: as Severus, Probus, and Aurelius, are called *ſui nominis imperatores*.

It was the uſual way of giving names, to wiſh the children might diſcharge their names. Thus when Gunthram king of France named Clotharius at the font, he ſaid, *Creſcat puer, & hujus ſit hominis executor*.

The ancient Britons, Camden ſays, generally took their names from colours, becauſe they painted themſelves; which names are now loſt, or remain hid among the Welſh. When they were ſubdued by the Romans, they took Roman names, ſome of which ſtill remain, corrupted; though the greateſt part became extinct upon the admiſſion of the Engliſh Saxons, who introduced the German names, as *Cridda*, *Penda*, *Oſwald*, *Edward*, &c.—The Danes, too, brought with them their names; as *Suayne*, *Harold*, *Knute*, &c. The Normans, at the Conqueſt, brought in other German names, as originally uſing the German tongue; ſuch as *Robert*, *William*, *Richard*, *Henry*, *Hugh*, &c. after the ſame manner as the Greek names: *Aſpaſius*, *Boethius*, *Symmachus*, &c. were introduced into Italy upon the diviſion of the empire. After the Conqueſt, our nation, which had ever been averſe to foreign names, as deeming them unlucky, began to take Hebrew names; as *Matthew*, *David*, *Sampſon*, &c. The various names anciently or at preſent obtaining among us, from what language or people ſoever borrowed, are explained by Camden in his Remains. As to the period when names began to be multiplied, and ſurnames introduced, &c. ſee SURNAME.

Of late years it has obtained among us to give ſurnames for Chriſtian names; which ſome diſlike, on account of the confuſion it may introduce. Camden relates it as an opinion, that the practice firſt began in the reign of Edward VI. by ſuch as would be godfathers, when they were more than half fathers. Upon which ſome were perſuaded to change their names at confirmation; which, it ſeems, is uſual in other countries.—Thus, two ſons of Henry II. of France, chriſtened *Alexander* and *Hercules*, changed them at confirmation into *Henry* and *Francis*. In monaſteries, the religious aſſume new names at their admittance, to ſhow they are about to lead a new life, and have renounced the world, their family, and even their name: *v. g.* ſiſter Mary *of the Incarnation*, brother Henry *of the Holy Sacrament*, &c. The popes alſo changed their names at their exaltation to the pontificate; a cuſtom firſt introduced by Pope Sergius, whoſe name till then, as Platina informs us, was *Swineſnout*. But Onuphrius refers it to John XII. or XIII. and at the ſame time adds a different reaſon for it from that of Platina, viz. that it was done in imitation of St Peter and St Paul, who were firſt called *Simon* and *Saul*.

Among the ancients, thoſe deified by the Heathen conſecrations had new names given them; as Romulus was called *Quirinus*; Melicertes, *Portunus* or *Portumnus*, &c.

New names were alſo given in adoptions, and ſometimes by teſtament: thus L. Æmilius, adopted by Scipio, took the name of *Scipio Africanus*; and thus Auguſtus, who at firſt was called *C. Octavius Thurinus*, being adopted by the teſtament of Julius Cæſar into his name and family, took the name of *Caius Julius Cæſar Octavianus*.

Names were alſo changed at enfranchiſements into new cities. Thus Lucumo, at his firſt being made free of Rome, took the name *Lucius Tarquinius Priſcus*, &c.; and ſlaves, when made free, uſually aſſumed their maſters names. Thoſe called to the equeſtrian order, if they had baſe names, were always new named, *nomine ingenuorum, veterumque Romanorum*. And among the primitive Chriſtians, it was the practice to change the names of the catechumens. Thus the renegado Lucianus, till his baptiſm, was called *Lucius*.

Toward the middle of the 15th century, it was the fancy of the wits and learned men of the age, particularly in Italy, to change their baptiſmal names for claſſical ones. As Sannazarius, for inſtance, who altered his own plain name *Jacopo* to *Actius Syncerus*. Numbers did the ſame, and among the reſt Platina the hiſtorian at Rome, who, not without a ſolemn ceremonial,

remonial, took the name of *Callimachus* inftead of *Philip*. Pope Paul II. who reigned about that time, unluckily chanced to be fufpicious, illiterate, and heavy of comprehenfion. He had no idea that perfons could wifh to alter their names unlefs they had fome bad defign, and actually fcrupled not to employ imprifonment and other violent methods to difcover the fancied myftery. Platina was moft cruelly tortured on this frivolous account: he had nothing to confefs; fo the pope, after endeavouring in vain to convict him of herefy, fedition, &c. releafed him after a long imprifonment.

NAMPTWICH, or NANTWICH, a town of Chefhire in England, fituated on the Weever river, 14 miles S. E. from Chefter and 162 miles from London. It lies in the Vale-Royal, and is one of the largeft and beft built towns in the county, the ftreets being very regular, and adorned with many gentlemens houfes. The inhabitants drive a trade, not only by its large market on Saturday for corn and cattle, and its great thoroughfare to Ireland, but by its cheefe and its fine white falt, which are made here to the greateft perfection; and by fhoes made here and fent to London to the warehoufes. It is governed by a conftable, &c. who are guardians of the falt-fprings. It is divided by the Weever into two equal parts, which is not navigable any farther than Winsford bridge. The Chefter canal, lately completed, terminates in a handfome broad bafon near this place. In this town were feveral religious foundations, now no more. The church is a handfome pile of building in the form of a crofs, with an octangular tower in the middle. There are here three fairs.

NAMUR, a province of the Netherlands, lying between the rivers Sambre and Maefe; bounded on the north by Brabant, on the eaft and fouth by the bifhopric of Leige, and on the weft by Hainault. It is pretty fertile; has feveral forefts, marble quarries, and mines of iron, lead, and pit-coal; and is about 30 miles long and 20 broad. Namur is the capital town.

NAMUR, a large, rich, and very ftrong town of the Netherlands, capital of the county of Namur, with a ftrong caftle, feveral forts, and a bifhop's fee. The moft confiderable forts are, Fort-William, Fort-Maefe, Fort Coquelet, and Fort-Efpinor. The caftle is built in the middle of the town, on a craggy rock. It was befieged by king William in 1695, who took it in the fight of an army of 100,000 French, though there were 60,000 men in garrifon. Namur is now a barrier-town, and has a Dutch garrifon. It was ceded to the houfe of Auftria in 1713, but taken by the French in 1746; and reftored by the treaty of Aix-la-Chapelle. It is fituated between two mountains, at the confluence of the rivers Maefe and Sambre, in E. Long. 4. 57. N. Lat. 50. 25.

NAN-TCHANG-FOU, the capital of Kiang-fi, a province of China. This city has no trade but that of porcelain, which is made in the neighbourhood of Jao-tcheou. It is the refidence of a viceroy, and comprehends in its diftrict eight cities; feven of which are of the third clafs, and only one of the fecond. So much of the country is cultivated, that the paftures left are fcarcely fufficient for the flocks.

NANCI, a town of France, and capital of Lorrain, is fituated on the river Meufe, in the centre of the province. It is divided into the Old and New Towns. The firft, though irregularly built, is very populous, and contains the ducal palace: the ftreets of the New Town are as ftraight as a line, adorned with handfome buildings, and a very fine fquare. The primatial church is a magnificent ftructure, and in that of the Cordeliers are the tombs of the ancient dukes. The two towns are feparated by a canal; and the new town was very well fortified, but the king of France has demolifhed the fortifications. It has been taken and retaken feveral times; particularly by the French, to whom it was ceded in 1736, to enjoy it after the death of Staniflaus.

NANI (John-Baptift), was born in 1616. His father was procurator of St Mark, and ambaffador from Venice to Rome. He was educated with attention, and made confiderable improvement. Urban VIII. a juft valuer of merit, foon perceived that of young Nani. He was admitted into the college of fenators in 1641, and was fhortly after nominated ambaffador in France, where he fignalized himfelf by his compliant manners. He procured confiderable fuccours for the war of Candia againft the Turks; and became, after his return to Venice, fuperintendant of the war-office and of finances. He was afterwards ambaffador to the empire; where he rendered thofe fervices to his country which, as a zealous and intelligent citizen, he was well qualified to difcharge. He was again fent into France in 1660 to folicit frefh fuccours for Candia; and on his return was appointed procurator of St Mark. He died November 5. 1678, at the age of 63, much regretted by his countrymen. The fenate had appointed him to write the Hiftory of the Republic; which he executed to the fatisfaction of the Venetians, although the work was lefs admired by foreigners, who were not proper judges of the accuracy with which he ftated the facts, of the purity of his diction, nor of the fimplicity of his ftyle; although it muft be acknowledged that his narrative is much interrupted by too frequent parenthefes. In writing his hiftory of Venice he has given an univerfal hiftory of his times, efpecially with refpect to the affairs of the French in Italy. This hiftory, which is continued from 1613 to 1671, was printed at Venice in 2 vols 4to, in the years 1662 and 1679.

NAN-KING, a city of China, and capital of the province of King-nan, is faid to have been formerly one of the moft beautiful and flourifhing cities in the world. When the Chinefe fpeak of its extent, they fay, if two horfemen fhould go out by the fame gate, and ride round it on full fpeed, taking different directions, they would not meet before night. This account is evidently exaggerated: but it is certain, that Nanking furpaffes in extent all the other cities of China. We are affured that its walls are five leagues and a half in circumference.

This city is fituated at the diftance of a league from the river Yang-tfe-kiang: it is of an irregular figure; the mountains which are within its circumference having prevented its being built on a regular plan. It was formerly the imperial city; for this reafon it was called *Nan-King*, which fignifies, "the Southern Court;"

Court;" but fince the fix grand tribunals have been transferred from hence to Peking, it is called *Kiang-ning* in all the public acts.

Nan-king has loft much of its ancient fplendour: it had formerly a magnificent palace, no veftige of which is now to be feen; an obfervatory at prefent neglected, temples, tombs of the emperors, and other fuperb monuments, of which nothing remains but the remembrance. A third of the city is deferted, but the reft is well inhabited. Some quarters of it are extremely populous and full of bufinefs; particularly the manufacture of a fpecies of cotton cloth, of which great quantities are imported into Europe under the name of *Nankin*. The ftreets are not fo broad as thofe of Peking; they are, however, very beautiful, well-paved, and bordered with rich fhops.

In this city refides one of thofe great mandarins called *Tfong-gtou*, who takes cognizance of all important affairs, not only of both the governments of the province, but alfo of thofe of the province of Kiang-fi. The Tartars have a numerous garrifon here, commanded by a general of their own nation; and they occupy a quarter of the city, feparated from the reft by a plain wall.

The palaces of the mandarins, whether Chinefe or Tartars, are in this city neither larger nor better built than thofe in the capital cities of other provinces. Here are no public edifices correfponding to the reputation of fo celebrated a city, excepting its gates, which are very beautiful, and fome temples, among which is the famous porcelain tower. It is 200 feet high, and divided into nine ftories by plain boards within, and without by cornices and fmall projections covered with green varnifhed tiles. There is an afcent of 40 fteps to the firft ftory; between each of the others there are 21.

The breadth and depth of the river Yang-tfe-kiang formerly rendered the port of Nan-king very commodious; but at prefent large barks, or rather Chinefe junks, never enter it; whether it be that it is fhut up by fand-banks, or that the entrance of it has been forbid, in order that navigators may infenfibly lofe all knowledge of it.

In the months of April and May a great number of excellent fifh are caught in this river near the city, which are fent to court; they are covered with ice, and tranfported in that manner by barks kept entirely on purpofe. Although this city is more than 200 leagues from Peking, thefe boats make fuch expedition, that they arrive there in eight or nine days. This city, though the capital of the province, has under its particular jurifdiction only eight cities of the third clafs. The number of its inhabitants are faid to be 1,000,000, without comprehending the garrifon of 40,000 men. E. Long. 119. 25. N. Lat. 32. 46.

NANSIO, an ifland of the Archipelago, a little to the north of the ifland of Santorino, 16 miles in circumference; but has no harbour. The mountains are nothing but bare rocks, and there are not fprings fufficient to water the fields. There are a vaft number of partridges, whofe eggs they deftroy every year to preferve the corn, and yet vaft numbers of them are always produced. The ruins of the temple of Apollo are yet to be feen, and confift chiefly of marble columns. E. Long. 26. 20. N. Lat. 36. 15.

NANTES, an ancient, rich, and very confiderable town of France, in Bretagne, with a bifhop's fee, an univerfity, and a mint. It is one of the moft confiderable places in the kingdom; contains the richeft merchants; and was formerly the refidence of the dukes of Bretagne, where they built a very ftrong caftle on the fide of the river, and which is ftrongly fortified. There are feveral parifhes, and a great many religious houfes, and the cathedral contains the tombs of the ancient dukes. There are feveral fine bridges over the river Loire, which is navigable. The fuburbs are fo large, on account of the number of people that come from all parts to fettle here, that they exceed the city. The Spaniards trade here with wine, fine wool, iron, filk, oil, oranges, and lemons; and they carry back cloth, ftuffs, corn, and hard-ware. The Dutch fend falt fifh, and all forts of fpices; and in return have wine and brandy. The Swedes bring copper; and the Englifh, lead, tin, and pit-coal. It was in this place that Henry IV. promulgated the famous edict in 1598, called the *Edict of Nantes*, and which was revoked in 1685. Nantes was anciently, like almoft every confiderable city in Europe, very ftrongly fortified. Peter de Dreux, one of the dukes of Bretagne, furrounded it with walls, which have only been demolifhed within thefe few years. The bridge is an object of curiofity. It is near a mile and a half in length, being continued acrofs all the little iflands in the Loire, from north to fouth. The territory of Nantes lies on both fides the Loire, and feeds a great number of cattle. Large veffels can come no higher than Port Launai, which is 12 miles from Nantes. W. Long. 1. 31. N. Lat. 47. 13.

NANTUEIL (Robert), the celebrated defigner and engraver to the cabinet of Louis XIV. was born at Rheims in 1630. His father, though but a petty fhopkeeper, gave his fon a liberal education; who, having a tafte for drawing, cultivated it with fuch fuccefs, that he became the admiration of the whole town: but marrying young, and not being able to maintain his family, he took a journey to Paris, where he made his talents known by a ftratagem.—Seeing feveral abbés at the door of an eating-houfe, he afked the miftrefs for an ecclefiaftic of Rheims, whofe name he had forgot, but that fhe might eafily know him by a picture of him which he fhowed: the abbés crowding round, were fo charmed with it, that he feized the opportunity of offering to draw any of their pictures for a fmall matter. Cuftomers came fo faft, that he foon raifed his price, and brought his family to Paris, where his reputation was quickly eftablifhed. He applied himfelf particularly to taking portraits in crayons, which he afterwards engraved for the ufe of academical thefes; and in this way he did the portrait of the king, and afterwards engraved it as big as the life; a thing never before attempted. The king was fo pleafed with it, that he created the place of defigner and engraver to the cabinet for him, with a penfion of 1000 livres. He died in 1678; and an entire collection of his prints amounts to upwards of 240.

NANTWICH. See Namptwich.

NAPÆA, in botany: A genus of the polyandria order, belonging to the polydelphia clafs of plants; and in the natural method ranking under the 37th order, *Columniferæ*. The calyx is fingle and cylindric; the

Naphtha. the arilli coalited and monofpermous. There are two fpecies; both of them with perennial roots, compofed of many thick flefhy fibres, which ftrike deep into the ground, and are connected at the top into large heads; the ftalks grow to feven or eight feet high, producing white flowers, tubulous at bottom, but fpreading open at top, and dividing into five obtufe fegments. Both thefe plants are natives of Virginia and other parts of North America: from the bark of fome of the Indian kinds a fort of fine hemp might be procured, capable of being woven into very ftrong cloth. They are eafily propagated by feed, which will thrive in any fituation.

NAPHTHA, an inflammable fubftance of the bituminous kind, of a light brown colour, and incapable of decompofition, though frequently adulterated with heterogeneous mixtures. By long keeping it hardens in the air into a fubftance refembling a vegetable refin; and in this ftate it is always of a black colour, whether pure or mixed with other bodies. According to Mongez, there are three kinds of naphtha, the white, reddifh, and green or deep-coloured; and it is in fact a true petrol or rock oil, of which the lighteft and moft inflammable is called *naphtha*. It is faid to be of an extremely fragrant and agreeable fmell, though very different in this refpect from vegetable oils. It is alfo tranfparent, extremely inflammable, diffolves refins and balfams, but not gum-refins nor elaftic gum. It diffolves in the effential oils of thyme and lavender, but is infoluble in fpirit of wine and ether. It burns with a bluifh flame, and is as inflammable as ether; like which it alfo attracts gold from aqua-regia.

Naphtha, according to Cronftedt, is collected from the furface of fome wells in Perfia; but Mr Kirwan informs us, that it iffues out of white, yellow, or black clays, in Perfia and Media. The fineft is brought from a peninfula in the Cafpian Sea, called by Kempfer *okefra*. It iffues out through the earth into cifterns and wells, purpofely excavated for collecting it at Baku in Perfia. Different kinds of this fubftance are alfo found in Italy, in the duchy of Modena, and in Mount Ciaro, 12 leagues from Plaifance.

The formation of naphtha and petroleum is by moft naturalifts and chemifts afcribed to the decompofition of folid bitumens by the action of fubterraneous fires; naphtha being the lighteft oil, which the fire difengages firft; what follows gradually acquiring the colour and confiftence of petrol. Laftly, the petrolea, united with fome earthy fubftances, or altered by acids, affume the appearance of mineral pitch, piffafphaltum, &c. This opinion feems to be fupported by the phenomena attending the diftillation of amber; where the firft liquor that rifes is a true naphtha; then a petroleum of a more or lefs brown colour; and laftly, a black fubftance like jet, which being farther urged by the fire, leaves a dry friable matter, &c. It is further obferved, that nature frequently produces all the different kinds of petrolea near the fame fpot; of which we have an inftance at Mount Teftin in the duchy of Modena in Italy. Some, however, are of opinion, that thefe mineral oils or bitumens are formed from the vitriolic acid, and various oily and fat fubftances found in the bowels of the earth.

NAPHTHALI, or NEPHTHALI (Jofh. xix.), one of the tribes of Ifrael; having Zabulon on the fouth, Afher on the weft, the Jordan on the eaft, and on the north Antilibanus. Naphthali, Napier.

NAPIER (John), baron of Merchifton in Scotland, inventor of the logarithms, was the eldeft fon of Sir Archibald Napier of Merchifton, and born in the year 1550. Having given early difcoveries of great natural parts, his father was careful to have them cultivated by a liberal education. After going through the ordinary courfes of philofophy at the univerfity of St Andrew's, he made the tour of France, Italy, and Germany. Upon his return to his native country, his literature and other fine accomplifhments foon rendered him confpicuous, and might have raifed him to the higheft offices in the ftate; but declining all civil employments, and the buftle of the court, he retired from the world to purfue literary refearches, in which he made an uncommon progrefs, fo as to have favoured mankind with fundry ufeful difcoveries. He applied himfelf chiefly to the ftudy of mathematics; but at the fame time did not neglect that of the Holy Scriptures. In both thefe he hath difcovered the moft extenfive knowledge and profound penetration. His effay upon the book of the Apocalypfe, indicates the moft acute inveftigation, and an uncommon ftrength of judgment; though time hath difcovered, that his calculations concerning particular events had proceeded upon fallacious data. This work has been printed abroad in feveral languages; particularly in French at Rochelle in the year 1693, 8vo, announced in the title as revifed by himfelf. Nothing, fays Lord Buchan, could be more agreeable to the Rochellers or to the Huguenots of France at this time, than the author's annunciation of the pope as antichrift, which in this book he has endeavoured to fet forth with much zeal and erudition.—But what has principally rendered his name famous, was his great and fortunate difcovery of logarithms in trigonometry, by which the eafe and expedition in calculation have fo wonderfully affifted the fcience of aftronomy and the arts of practical geometry and navigation. That he had begun about the year 1593 the train of enquiry which led him to that great atchievement in arithmetic, appears from a letter to Crugerus from Kepler in the year 1624; wherein, mentioning the *Canon Mirificus*, he writes thus: "Nihil autem fupra Neperianam rationem effe puto: etfi Scotus quidem literis ad Tychonem, anno 1594, fcriptis jam fpem fecit Canonis illius mirifici;" which allufion agrees with the idle ftory mentioned by Wood in his *Athenæ Oxon.* and explains it in a way perfectly confonant to the rights of Napier as the inventor.

When Napier had communicated to Mr Henry Briggs, mathematical profeffor in Grefham college, his wonderful canon for the logarithms, that learned profeffor fet himfelf to apply the rules in his *Imitatio Nepeirea*; and in a letter to archbifhop Ufher in the year 1615, he writes thus: "Napier, baron of Merchifton, hath fet my head and hands at work with his new and admirable logarithms. I hope to fee him this fummer, if it pleafe God; for I never faw a book which pleafed me better, and made me more wonder." The following paffage from the life of Lilly the aftrologer is quoted by Lord Buchan as giving a picturefque

resque view of the meeting betwixt Briggs and the inventor of the logarithms at Merchiston near Edinburgh. "I will acquaint you (says Lilly) with one memorable story related unto me by John Marr, an excellent mathematician and geometrician, whom I conceive you remember. He was servant to King James I. and Charles I. When Merchiston first published his logarithms, Mr Briggs, then reader of the astronomy lectures at Gresham college in London, was so much surprised with admiration of them, that he could have no quietness in himself until he had seen that noble person whose only invention they were: he acquaints John Marr therewith, who went into Scotland before Mr Briggs, purposely to be there when these two so learned persons should meet. Mr Briggs appoints a certain day when to meet at Edinburgh; but failing thereof, Merchiston was fearful he would not come. It happened one day as John Marr and the baron Napier were speaking of Mr Briggs; 'Ah, John (said Merchiston), Mr Briggs will not now come.' At the very instant one knocks at the gate; John Marr hasted down, and it proved to be Mr Briggs to his great contentment. He brings Mr Briggs up to the Baron's chamber, where almost one quarter of an hour was spent, each beholding other with admiration before one word was spoken. At last Mr Briggs began: 'Sir, I have undertaken this long journey purposely to see your person, and to know by what engine of wit or ingenuity you came first to think of this most excellent help into astronomy, *viz* the logarithms; but, Sir, being by you found out, I wonder nobody else found it out before, when now being known it appears so easy.' He was nobly entertained by baron Napier; and every summer after that, during the laird's being alive, this venerable man Mr Briggs went purposely to Scotland to visit him."

Earl of Buchan's Account of the Writings and Inventions of Napier of Merchiston.

There is a passage in the life of Tycho Brahe by Gassendi, which may mislead an attentive reader to suppose that Napier's method had been explored by Herwart at Hoenburg: It is in Gassendi's Observations on a Letter from Tycho to Herwart of the last day of August 1599. "Dixit Hervartus nihil morari se solvendi cujusquam trianguli difficultatem; solere se enim multiplicationum, ac divisionum vice additiones solum, subtractiones 93 usurpare (quod ut fieri posset, docuit postmodum suo Logarithmorum Canone Neperus.)" But Herwart here alludes to his work afterwards published in the year 1610, which solves triangles by prostaphæresis; a mode totally different from that of the logarithms.

Kepler dedicated his *Ephemerides* to Napier, which were published in the year 1617; and it appears from many passages in his letter about this time, that he held Napier to be the greatest man of his age in the particular department to which he applied his abilities. "And indeed (says our noble biographer), if we consider that Napier's discovery was not like those of Kepler or of Newton, connected with any analogies or coincidences which might have led him to it, but the fruit of unassisted reason and science, we shall be vindicated in placing him in one of the highest niches in the temple of fame. Kepler had made many unsuccessful attempts to discover his canon for the periodic motions of the planets, and hit upon it at last, as he himself candidly owns on the 15th of May 1618; and Newton applied the palpable tendency of heavy bodies to the earth to the system of the universe in general; but Napier sought out his admirable rules by a slow scientific progress, arising from the gradual evolution of truth."

The last literary exertion of this eminent person was the publication of his *Rabdology and Promptuary* in the year 1617, which he dedicated to the Chancellor Seton; and soon after died at Merchiston on the 3d of April O. S. of the same year, in the 68th year of his age and 23d of his happy invention.—The particular titles of his published works are: 1. A plain discovery of the Revelation of St John. 2. *Mirifici ipsius canonis constructio et logarithmorum, ad naturales ipsorum numeros habitudines.* 3. *Appendix de alia atque præstantiore logarithmorum specie constituenda, in qua scilicet unitas logarithmus est.* 4. *Rhabdologiæ, seu numerationis per virgulas, libri duo.* 5. *Propositiones quædam eminentissimæ, ad triangula sphærica mira facultate resolvenda.* To which may be added, 6. His Letter to Anthony Bacon (the original of which is in the archbishop's library at Lambeth), intitled, "Secret inventions, profitable and necessary in these days for the defence of this island, and withstanding strangers enemies to God's truth and religion;" which the earl of Buchan has caused to be printed in the Appendix to his Account of Napier's Writings. This letter is dated June 2. 1596, about which time it appears the author had set himself to explore his logarithmic canon.

This eminent person was twice married. By his first wife, who was a daughter of Sir James Stirling of Keir, he had only one son named Archibald, who succeeded to the estate. By his second wife, a daughter of Sir James Chisholm of Cromlix, he had a numerous issue.—*Archibald Napier*, the only son of the first marriage, was a person of fine parts and learning. Having more a turn to public business than his father had, he was raised to be a privy counsellor by James VI. under whose reign he also held the offices of treasurer depute, justice-clerk, and senator of the college of justice. By Charles I. he was raised to the peerage by the title of *Lord Napier*.

Napier's Rods, or *Bones*, an instrument invented by Baron Napier, whereby the multiplication and division of large numbers is much facilitated.

As to the Construction of Napier's Rods: Suppose the common table of multiplication to be made upon a plate of metal, ivory, or pasteboard, and then conceive the several columns (standing downwards from the digits on the head) to be cut asunder; and these are what we call *Napier's rods for multiplication.* But then there must be a good number of each; for as many times as any figure is in the multiplicand, so many rods of that species (*i. e.* with that figure on the top of it) must we have; though six rods of each species will be sufficient for any example in common affairs: there must be also as many rods of o's.

But before we explain the way of using these rods, there is another thing to be known, *viz.* that the figures on every rod are written in an order different from that in the table. Thus the little square space or division in which the several products of every column are written, is divided into two parts by a line across from the upper angle on the right to the lower on the left; and if the product is a digit, it is set in the

the lower diviſion; if it has two places, the firſt is ſet in the lower, and the ſecond in the upper diviſion; but the ſpaces on the top are not divided; alſo there is a rod of digits, not divided, which is called the *index rod*, and of this we need but one ſingle rod. See the figure of all the different rods, and the index, ſeparate from one another, in Plate CCCXLIV.

Multiplication by Napier's Rods. Firſt lay down the index-rod; then on the right of it ſet a rod, whoſe top is the figure in the higheſt place of the multiplicand: next to this again, ſet the rod whoſe top is the next figure of the multiplicand; and ſo on in order to the firſt figure. Then is your multiplicand tabulated for all the nine digits; for in the ſame line of ſquares ſtanding againſt every figure of the index rod, you have the product of that figure; and therefore you have no more to do but to transfer the products and ſum them. But in taking out theſe products from the rods, the order in which the figures ſtand obliges you to a very eaſy and ſmall addition: thus, begin to take out the figure in the lower part, or units place, of the ſquare of the firſt rod on the right; add the figure in the upper part of this rod to that in the lower part of the next, and ſo on; which may be done as faſt as you can look on them. To make this practice as clear as poſſible, take the following example.

Example: To multiply 4768 by 385. Having ſet the rods together for the number 4768 (*ibid.* n° 2.) againſt 5 in the index, I find this number, by adding

according to the rule, - - -	23840
Againſt 8, this number - - -	38144
Againſt 3, this number - -	14304
Total product - - -	1835680

To make the uſe of the rods yet more regular and eaſy, they are kept in a flat ſquare box, whoſe breadth is that of ten rods, and the length that of one rod, as thick as to hold ſix (or as many as you pleaſe) the capacity of the box being divided into ten cells, for the different ſpecies of rods. When the rods are put up in the box (each ſpecies in its own cell diſtinguiſhed by the firſt figure of the rod ſet before it on the face of the box near the top), as much of every rod ſtands without the box as ſhows the firſt figure of that rod: alſo upon one of the flat ſides without and near the edge, upon the left hand, the index rod is fixed; and along the foot there is a ſmall ledge, ſo that the rods when applied are laid upon this ſide, and ſupported by the ledge, which makes the practice very eaſy; but in caſe the multiplicand ſhould have more than nine places, that upper face of the box may be made broader. Some make the roads with four different faces, and figures on each for different purpoſes.

Diviſion by Napier's Rods. Firſt tabulate your diviſor; then you have it multiplied by all the digits, out of which you may chooſe ſuch convenient diviſors as will be next leſs to the figures in the dividend, and write the index anſwering in the quotient, and ſo continually till the work is done. Thus 2179788, divided by 6123, gives in the quotient 356.

Having tabulated the diviſor 6123, you ſee that 6123 cannot be had in 2179; therefore take five places, and on the rods find a number that is equal or next leſs to 21797, which is 18369; that is, 3 times the diviſor: wherefore ſet 3 in the quotient, and ſubtract 18369 from the figures above, and there will remain 3428; to which add 8, the next figure of the dividend, and ſeek again on the rods for it, or the next leſs, which you will find to be five times; therefore ſet 5 in the quotient, and ſubtract 30615 from 34288, and there will remain 3673; to which add 8, the laſt figure in the dividend, and finding it to be juſt 6 times the diviſor, ſet 6 in the quotient.

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6123)2179788(356
     18369..
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      34288
      30615
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       36738
       36738
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NAPLES, a kingdom of Italy, comprehending the ancient countries of Samnium, Campania, Apulia, and Magna Græcia. It is bounded on all ſides by the Mediterranean and Adriatic, except on the north-eaſt, where it terminates on the Eccleſiaſtical ſtate. Its greateſt length from ſouth-eaſt to north-weſt is about 280 Engliſh miles; and its breadth from north-eaſt to ſouth-weſt, from 96 to 120.

The ancient hiſtory of this country falls under the articles ROME and ITALY; the preſent ſtate of it, as well as of the reſt of Italy, is owing to the conqueſts of Charlemagne. When that monarch put an end to the kingdom of the Lombards, he obliged the dukes of Friuli, Spoleto, and Benevento, to acknowledge him as king of Italy; but allowed them to exerciſe the ſame power and authority which they had enjoyed before his conqueſt. Of theſe three dukedoms Benevento was by far the moſt powerful and extenſive, as it comprehended almoſt all the preſent kingdom of Naples; that part of Farther Calabria beyond the rivers Savuto and Peto, a few maritime cities in Hither Calabria, with the city of Acripoli, and the promontory in its neighbourhood called *Capo di Licoſa*; and laſtly, the dukedoms of Gaeta, Naples, and Amalfi, which were very inconſiderable, and extended along the ſhore only about 100 miles, and were interrupted by the Gaſtaldate or county of Capua.

1
Extent of the duchy of Benevento.

2
Arechis duke of Benevento revolts from Charlemagne.

This flouriſhing and extenſive dukedom was at this time governed by Arechis, who had married one of the daughters of the laſt king of the Lombards, and had ſubmitted, and taken the oath of allegiance to the emperor Charles. However, a few years after, he renounced his allegiance to the Franks, declared himſelf an independent ſovereign, and was acknowledged as ſuch by all the inhabitants of his duchy. To ſtrengthen himſelf againſt Pepin king of Italy, who reſided at Ravenna, he enlarged and fortified the city of Benevento, and likewiſe built Salerno on the ſea-coaſt, ſurrounding it with a very ſtrong and high wall. He engaged in ſeveral wars with the Greeks, whom he ſometimes obliged to give him hoſtages; but having invaded the territories of the pope, whom Pepin could not aſſiſt, Charlemagne was prevailed on to return to Italy. Arechis, unable to oppoſe ſuch a formidable enemy, ſent his eldeſt ſon, Romuald, to Rome, with an offer of ſubmiſſion: but, at the inſtigation of the pope, Charles refuſed the

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offer, and detained his ſon priſoner; after which he ravaged the country, and made himſelf maſter of Capua. Other deputies, however, proved more ſucceſsful; and, in the year 787, a peace was concluded on theſe conditions: That Arechis and the Beneventans ſhould renew their allegiance to the Franks; that he ſhould pay a yearly tribute to Pepin; deliver up all his treaſure; and give his ſon Grimoald and his daughter Adelgiſa, with twelve others, as hoſtages for his fidelity: however, after many intreaties, Adelgiſa was reſtored to her father.

3 Submits.

4 Revolts a ſecond time.

Charles had no ſooner left Italy, than Arechis forgot all his engagements, and began to negociate with Irene, empreſs of Conſtantinople, and her ſon Conſtantine, for expelling the Franks out of Italy. For himſelf, he deſired the honour of patriciate, and the dukedom of Naples with all its dependencies; and, in return, promiſed to acknowledge the Greek emperor as his ſovereign, and to live after the manner of the Greeks. He required, however, to be ſupported by a Greek army; and that his brother-in-law Adalgiſus, ſon to Deſiderius the laſt king of the Lombards, ſhould be ſent over into Italy, to raiſe a party among his countrymen. Theſe conditions were readily accepted, on condition that prince Romuald ſhould be ſent as an hoſtage; ambaſſadors were ſent to Naples with the enſigns of the patrician order, namely the mantle of cloth of gold, the ſword, the comb, and the ſandals: but before the ceremony could be performed, prince Romuald died, and ſoon after him his father; whoſe death was ſuppoſed to have been haſtened by that of his ſon.

5 Grimoald continues for ſome time faithful to the Franks.

After the death of Arechis, the Beneventans ſent a moſt ſubmiſſive embaſſy to Charlemagne, intreating him to ſend them Grimoald, the late king's ſon, and only lawful heir to his crown; threatening at the ſame time to revolt if their prince was denied them. Charles readily granted their requeſt, and allowed Grimoald to depart, after he had agreed to the following conditions, viz. That he ſhould oblige the Lombards to ſhave their beards; that, in writings, and on money, the name of the king ſhould be put before that of the prince; and that he ſhould cauſe the walls of Salerno, Acerenza, and Conſia, to be entirely demoliſhed.—The new king was received by his ſubjects with the utmoſt joy; and for ſome time continued faithful to his engagements, excepting only the laſt article, which he either neglected or eluded. So far, however, was he from aſſiſting the Greeks, that he gave notice of their machinations to Pepin king of Italy; raiſed an army to oppoſe his uncle Adalgiſus; and being joined by Hildebrand duke of Spoleto, and Vinigiſe the general of Pepin, he attacked the Greeks in Calabria ſoon after they had landed, entirely defeated and took his uncle priſoner, and, as is ſaid, put him to a cruel death. Yet in a ſhort time Grimoald contracted an alliance with the Greek emperor by marrying his neice Wanzia; and in the fifth year of his reign a war broke out between him and Pepin, which continued for twelve years; at the end of which time a truce was concluded. Grimoald ſurvived this pacification only three years, and was ſucceeded by his treaſurer Grimoald II. who ſubmitted to Charlemagne after the death of Pepin; and from this time the Beneventans were looked upon as tributaries of the weſtern emperors.

As yet, however, the city of Naples did not own allegiance to the dukes of Benevento, but was held by the eaſtern emperors; and frequent wars took place between the Beneventans and Neapolitans. This happened to be the caſe when Grimoald II. aſcended the throne. He concluded a peace with them; which however, was of no long continuance; for Theodore, governor of Naples, having granted protections to Dauferius a noble Beneventan, who had been concerned in a conſpiracy againſt his prince, Grimoald marched againſt the city of Naples, and inveſted it by ſea and land. Theodore ſtill refuſed to deliver up the traitor, and a general engagement both by land and ſea was the conſequence; in which the Neapolitans were defeated with ſo great ſlaughter, that the ſea was ſtained with their blood for more than ſeven days. Theodore then conſented to deliver up Dauferius, with 8000 crowns for the expences of the war; and Grimoald not only pardoned Dauferius, but received him into favour: the traitor, however, reflecting on the heinouſneſs of his crime, was ſeized with remorſe; and went a pilgrimage to the holy land, carrying a large ſtone in his mouth, by way of penance, which he never took out but at his meals.

In the year 821, Grimoald was murdered by Radelchis count of Conſia, and Sico gaſtald of Acerenta, the latter of whom ſucceeded to the dukedom of Benevento. Radelchis being ſoon after ſeized with remorſe, became a monk; while Sico aſſociated his ſon Sicardo with him in the government; and both, being of an ambitious and reſtleſs diſpoſition, ſought a pretence for attacking the Neapolitans. This was ſoon found, and the city was inveſted by ſea and land. The walls were furiouſly battered; and part of them being beat down, Sico prepared for a general aſſault. Stephen, at that time duke of Naples, pretended to ſubmit; but, that he might prevent the city from being pillaged, intreated Sico to put off his entry till the morning, and in the mean time ſent out his mother and his two children as hoſtages. Sico conſented to his requeſt; but next morning found the breach built up, and the Neapolitans prepared for their defence. Exaſperated at their perfidy, he renewed his attacks with vigour, but without any ſucceſs; the beſieged defending themſelves with the utmoſt obſtinacy. At laſt, perceiving that they ſhould not be able to hold out much longer, they conſented to a peace on the following conditions, viz. That the Neapolitans ſhould pay an annual tribute to the princes of Benevento, and conſent to the tranſporting of the body of St Januarius from his church without the walls of Naples to Benevento. Theſe conditions being ratified, Sico returned with great honour to Benevento; but ſoon after renewed the war, under pretence that the Neapolitans had neglected to pay the ſtipulated ſum; and hoſtilities continued till his death, which happened in 833.

6 Is murdered, and ſucceeded by Sico.

7 Naples beſieged by Sico;

8 And by his ſucceſſor Sicardo.

Sico was ſucceeded in the government of Benevento by his ſon Sicardo, who had married the daughter of Dauferius; and being influenced by the evil counſels of Roffrid his wife's brother, oppreſſed his ſubjects to ſuch a degree that they conſpired againſt his life. He beſieged Naples with a powerful army, and took poſſeſſion of Acerra and Atella, both of which he fortified. But Bonus, the Neapolitan duke, defended himſelf

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himself so vigorously, that the Beneventans were obliged to retire, and even to abandon Acerra and Atella, the fortifications of which were immediately demolished. At last Sicardo agreed to a peace for five years, on the intercession of Lothaire, emperor and king of Italy; but his chief motive was thought to have been the fear of the Saracens, whom the duke of Naples had called over from Africa to his assistance: for no sooner were they sent back than Sicardo attempted to delay the conclusion of the treaty; but the emperor interposing his authority, a peace was concluded in the year 836, after the war had continued, with very little intermission, for 16 years.

9 …e Sara- …s called …y the …e of …ples.

Soon after the conclusion of this peace, the Saracens landed at Brindisi; and having made themselves masters of the place, ravaged all the neighbouring country. Sicardo marched against them with a numerous army; but the Saracens having dug a great number of ditches which they slightly covered over, found means to draw the Beneventans in among them, whereby they were repulsed with great loss. However, Sicardo, having reinforced his army, marched again to attack them; but the Saracens, despairing of success, pillaged and burnt Brindisi, and then retired with their booty, and a great many captives, to Sicily. Sicardo then, without any apparent provocation, attacked the city of Amalfi, levelled its walls with the ground, carried off all its wealth, and the body of its tutelar saint Triphomen. A great many of the inhabitants were transported to Salerno; and by promoting alliances between the inhabitants of both places, he endeavoured to unite Amalfi to his own principality as firmly as possible.

During all these transactions, Sicardo had tyrannized over his subjects in such a manner, that at last he became intolerable. Among other acts of injustice, he imprisoned his own brother Siconolphus; compelled him to turn priest; and afterwards sent him bound to Tarento, where he caused him to be shut up in an old tower that had been built for a cistern. By such acts of tyranny his nobles were provoked to conspire against him; and in the year 839 he was murdered in his tent.

10 …do …dered …adel- which …s on a war.

On the death of Sicardo, Radelchis, his secretary or treasurer, was unanimously elected prince of Benevento; but Siconolphus, the last king's brother, having regained his liberty, formed a great party against the new prince. Radelchis did not fail to oppose him with a formidable army; and a most ruinous civil war ensued. Both parties by turns called in the Saracens; and these treacherous allies acted sometimes against one, and sometimes against the other; or turned their arms against both, as seemed most suitable to their own interest. Thus the war continued with the utmost animosity for 12 years, during which time the principality was almost entirely ruined; till at last the emperor Lewis interposed, and obliged the competitors to agree to a partition of the principality. By this treaty, Radelchis promised to acknowledge Siconolphus and his successors as lawful princes of the principality of Salerno, which was declared to contain Tarento, Latiniano, Cassano, Cossenzo, Laino, Lucania, Consia, Montella, Rota, Salerno, Sarno, Ciraterium, Furculo, Capua, Feano, Sora, and the half of the Gastaldate of Acerenza, where it joins Latiano and Consia. The boundary betwixt Benevento and Capua was fixed at St Angelo ad Cerros; Alli Peregrini was made the boundary betwixt Benevento and Salerno, and Staffilo betwixt Benevento and Consia. The monasteries of Monte Cassino and St Vincent were declared to be immediately under the protection of the emperor: both princes stipulated that no hostilities should be committed by either against the subjects of each other; and promised to join their forces in order to drive out the Saracens. Soon after this pacification, however, both Radelchis and Siconolphus died; the former appointing his son Radelgarius, or Radelcar, to succeed him; and the latter leaving an infant son, Sico, to the care of his godfather, Peter.

11 …rin- …y di-

12 Unsuccessful war with the Saracens.

The war with the Saracens proved very unsuccessful; neither the united efforts of the princes, nor the assistance of the emperor Lewis himself, being able to expel the infidels; and, in 854, Adelgise the second son of Radelchis, who had now succeeded, on the death of his brother Radelcar, to the principality of Benevento, was obliged to pay them an annual subsidy. Two years after, Lando, count of Capua, revolted from the prince of Salerno, and could not be reduced. In the mean time, Sico, the lawful prince of Salerno, had been poisoned by Count Lando, and the principality usurped by Ademarius, the son of Peter above mentioned; but in 861, Ademarius himself was seized and imprisoned by Gauferius, the son of Dauferius formerly mentioned. This was occasioned by his cruelty and rapaciousness, which entirely alienated the hearts of his subjects from him, and encouraged Gauferius to become the head of the conspirators. The Saracens in the mean time committed terrible ravages throughout the Beneventan territories; which at last obliged Adelgise to enter into an alliance with Gauferius, and both together sent a most humble embassy to the emperor Lewis, requesting him to take them under his protection. About the same time an embassy arrived from Constantinople, proposing a junction of the forces of the eastern and western empires against the infidels; upon which Lewis gave orders for assembling a formidable army. But in the mean time Adelgise fell off from his alliance, and made peace with the Saracens; nay, according to some, he encouraged them in their incursions, and it was at his desire that they invaded the duchy of Capua, and afterwards that of Naples, which they ravaged in a most barbarous manner. The Neapolitans, in conjunction with the duke of Spoleto and the count of Marsi, endeavoured to oppose them; but being defeated, the Saracens continued their ravages with redoubled fury, and retired to Bari, which was their capital city, with an immense booty.

In 866, Lewis arrived at Sora with his army; and having marched to Capua, was there joined by Landulph, the bishop and count, with a body of Capuans: but Landulph soon after persuading his countrymen to desert, Lewis marched against that city, which he took after a siege of three months, and almost totally destroyed. In the end of the year he was joined by Guaferius with his quota of troops, having ordered the eyes of Ademarius to be put out in his absence. Lewis confirmed him in the principality, and marched with his army to Benevento, where Adelgise received

ceived him with great reſpect. Having reduced ſome inconſiderable places belonging to the Saracens, Lewis ſoon after inveſted Bari; but as the Saracens received continual ſupplies from their countrymen ſettled in Sicily, and beſides were protected by the Neapolitans, he could not reduce the place till the year 871, though he had received conſiderable aſſiſtance from his brother Lotharius, and the Greek emperor had ſent him a fleet of 200 ſail. The expulſion of the Saracens was completed the ſame year by the taking of Tarento; after which the emperor returned with great glory to Benevento, reſolving next to carry his arms into Sicily, and expel the infidels from thence alſo. But his future ſchemes of conqueſt were fruſtrated by a quarrel between him and Adelgiſe. The latter, pretending to have been inſulted by the empreſs, and oppreſſed by the French, ſeized the emperor himſelf, and kept him priſoner for 40 days. His impriſonment would probably have been of much longer continuance, had not a body of Saracens arrived from Africa, who, being joined by ſuch of their countrymen as had concealed themſelves in Italy, laid ſiege to Salerno with an army of 30,000 men, ravaging the neighbouring country at the ſame time with the utmoſt barbarity. By this new invaſion Adelgiſe was ſo much alarmed, that he ſet the emperor at liberty, but firſt obliged him to ſwear that he would not revenge the inſult that had been offered him, and that he would never return to Benevento. Lewis having then joined his forces to thoſe of the prince of Salerno, ſoon obliged the Saracens to raiſe the ſiege of Salerno; but though they were prevented from taking that city, they entirely deſtroyed the inhabitants of Calabria, leaving it, according to the expreſſion of one of the hiſtorians of that time, "as deſolate as it was at the flood."

13 They are at laſt expelled,

14 But ſoon return.

In the year 873, Lewis being abſolved from his oath by the pope, went to Benevento, and was reconciled to Adelgiſe; but ſoon after this reconciliation he died, and the Saracens continued their ravages to ſuch a degree that the inhabitants of Bari were conſtrained to deliver up their city to the Greeks. At the ſame time, the Salernitans, Neapolitans, Cajetans, and Amalfitans, having made peace with the Saracens, were compelled to agree to their propoſal of invading the territories of the Roman pontiff. His holineſs exerted himſelf to the utmoſt, both with ſpiritual and temporal weapons, in order to defend his right; but was at laſt reduced to the neceſſity of becoming a tributary to the infidels, and promiſing to pay them a large ſum annually.

15 The pope becomes their tributary.

In the mean time, all Italy was thrown into the greateſt confuſion by the death of Charles the Bald, who died of poiſon at Pavia, as he was coming to the pope's aſſiſtance. Sergius duke of Naples continued a firm friend to the infidels; nor could he be detached from their intereſts even by the thunder of a papal excommunication: but unluckily happening to fall into the hands of his brother Athanaſius biſhop of Naples, the zeal of that prelate prompted him to put out his eyes, and ſend him a cloſe priſoner to Rome; for which the higheſt encomiums were beſtowed on him by the holy father.

In 876, Adelgiſe was murdered by two of his nephews; one of whom, by name *Gaideris*, ſeized the principality. About the ſame time Landulph biſhop of Capua dying, a civil war enſued among his children, though their father's dominions had been divided among them according to his will. The princes of Salerno and Benevento, the duke of Spoleto, and Gregory the Greek governor of Bari and Otranto, took different ſides in the quarrel, as they thought moſt proper; and to complete the confuſion, the new biſhop was expelled, and his brother, though a layman, choſen to that office, and even conſecrated by the pope, who wrote to Gauferius, forbidding him to attack Capua under pain of excommunication. But though Gauferius was, in general, obedient to the pope's commands, he proved refractory in this particular, and laid ſiege to Capua for two years ſucceſſively.

Thus the Capuan territories were reduced to the moſt miſerable ſituation; being obliged to maintain at the ſame time the armies of the prince of Benevento and the duke of Spoleto. The Saracens, in the mean time, took the opportunity of ſtrengthening themſelves in Italy; and Athanaſius, notwithſtanding the great commendations he had received from the pope for putting out his brother's eyes, conſented to enter into an alliance with them, in conjunction with whom he ravaged the territories of the pope, as well as thoſe of Benevento and Spoleto, plundering all the churches, monaſteries, towns, and villages, through which they paſſed. At the ſame time the prince of Salerno was obliged to grant them a ſettlement in the neighbourhood of his capital; the duke of Geeta invited them to his aſſiſtance, being oppreſſed by the count of Capua; and even the pope himſelf was obliged to make peace with them, and to grant them a ſettlement on the north ſide of the Carigliano, where they fortified themſelves, and continued for more than 40 years.

To put a ſtop to the confuſion which reigned in Italy, the pope now thought proper to reſtore the biſhop of Capua, who had been expelled, but allowed his brother to reſide in the city, and govern one half of the dioceſe; but notwithſtanding this partition, the civil diſſenſions continued with the utmoſt violence, the neareſt relations murdering or baniſhing each other, according as the fortune of the one or the other prevailed.—Athanaſius, notwithſtanding all the pope's remonſtrances, continued his alliance with the Saracens; in conjunction with whom he ravaged the territory of Benevento, and fomented the diviſions in Capua, in hopes of being able to make a conqueſt of it. At laſt his holineſs thought proper to iſſue a ſentence of excommunication againſt him: but this attached him to the Saracens more than ever; inſomuch that he ſent to Suchaim, king of the Saracens in Sicily, deſiring him to come over and command a great body of his countrymen who had ſettled at the foot of Mount Veſuvius. Suchaim accepted the invitation, and immediately turned his arms againſt Athanaſius; allowing his troops to live at diſcretion in the territory of Naples, where they raviſhed the women, and plundered the inhabitants. Theſe calamities were, by the ſuperſtitious Neapolitans, imagined to be a conſequence of the ſentence of excommunication; and therefore they uſed their utmoſt endeavours to perſuade the prelate to conclude a league with ſome Chriſtian prince, and renounce all connection with the infidels. In this they at laſt proved ſucceſsful, and Athanaſius concluded an alliance with Guaimarius prince of Saler-

no;

Naples.

no; in conſequence of which the Saracens were obliged to quit the Neapolitan territories, and retire to Agropoli. Athanaſius then directed his force againſt Capua, of which he made himſelf maſter in the year 882. The Saracens, however, ſtill continued their incurſions, and ravaged ſeveral provinces in ſuch a manner, that they became entirely deſolate.

These confuſions continued for a long time; during which the Greeks found an opportunity of making themſelves maſters of Benevento, and had well nigh become maſters alſo of Salerno; but in this they failed through the treachery of the biſhop, and in the year 896 they were totally expelled by the biſhop, four years after they had become maſters of it. In 915 the Saracens received ſuch an overthrow at Carigliano, that ſcarce one of them remained. However, a new body ſoon arrived from Africa, and inveſted the ſea-coaſts for ſome time longer. A war alſo enſued between Landulph and the Greeks; which concluded diſadvantageouſly for the former, who was obliged to ſubmit to the emperor of Conſtantinople in 943.

16 e Saracens alm oſt ...irely cut

In 961, Otho the Great, king of Germany, invaded Italy with a powerful army againſt Berengarius III. and, marching to Rome, received the imperial crown from the hands of the Pope. In 964, he erected Capua into a principality, received homage from the other princes of Lombardy, and formed a deſign of recovering Puglia and Calabria from the Greeks. But in this laſt ſcheme he failed; and after various hoſtilities a treaty was concluded, and the young princeſs Theophania married to Otho's ſon, afterwards emperor.

All this time the Saracens continued their incurſions; and the Greeks had gained ground ſo much, that they were now in poſſeſſion of two thirds of the preſent kingdom of Naples; but in the year 1002 or 1003, the Normans firſt began to be remarkable in Italy. They had, about a century before, embraced Chriſtianity, and become very zealous in all the ſuperſtitions which were then practiſed. They were particularly zealous in viſiting ſacred places, eſpecially Rome, and the holy ſepulchre at Jeruſalem; and being naturally of a very martial diſpoſition, they forced through great bodies of Greeks and Saracens who oppoſed their paſſage. About this time 40, or, as others write, 100, of theſe Normans, returning from Jeruſalem by ſea, landed at Salerno in the habit of pilgrims, where they were honourably received by Guaimarius. During their reſidence at Salerno, a great body of Saracens landed, and inveſted the city. Guaimarius, not being in a condition to oppoſe the invaders by force, was preparing to pay them a large ſum of money, which they demanded, when the Normans propoſed to attack them; and, having got arms and horſes from the prince, they engaged the infidels with ſuch fury and bravery, that they entirely defeated them, and obliged them to fly to their ſhips. By this complete victory Guaimarius was filled with ſuch admiration of the valour of theſe ſtrangers, that he entreated them to remain in his country; offering them lands, and the moſt honourable employments: but not being able to prevail with them to ſtay in Italy, or even accept of his preſents; at their departure he ſent ſome ambaſſadors with them to Normandy, in veſſels loaded with exquiſite fruits, rich furniture for horſes, &c. in order to allure the valiant Normans to leave their own country. This kind invitation encouraged a Norman chief, named *Oſmond Drengot*, to ſettle in Italy about the year 1015; having killed another lord in a duel, which obliged him to leave his own country, in order to avoid the reſentment of his ſovereign, Robert duke of Normandy. In the mean time, the city of Bari had revolted from the Greeks, and choſen one Mello for their leader, whoſe wife and children happened ſoon after to fall into the hands of their enemies, and were ſent priſoners to Conſtantinople. No ſooner, therefore, did Mello hear of the arrival of theſe adventurers, than he engaged them to aſſiſt him; and having drawn together a conſiderable army, defeated the Greeks with great ſlaughter, and obliged them to abandon their camp. In this engagement the Normans diſtinguiſhed themſelves by their bravery; and the news of their ſucceſs ſoon brought from Normandy an innumerable multitude of their countrymen, with their wives and children. By this reinforcement, Mello gained two other victories, took a great many towns, and obliged the Greeks to abandon a large territory; but, in 1019, they were utterly defeated, and every thing recovered by the Greeks. The Greek general, Bajanus, continued to go on with ſuch ſurpriſing ſucceſs, that he almoſt entirely re-eſtabliſhed the affairs of his countrymen in Italy, and made a diſtinct province of the weſtern part of Puglia, which he called *Capatanata*, and which to this day retains the name of *Capitanata*. His great progreſs at laſt alarmed the emperors of Germany; and, in 1027, Pandulphus prince of Capua made himſelf maſter of Naples; but was obliged, three years afterwards, to leave it, by the Normans, who built the city of Averſa, which was now erected into a county. In conſequence of this piece of good fortune, great numbers of Norman adventurers migrated into Italy; among whom were William, Drogo, and Umbert, three of the ſons of Tancred duke of Hautville; from whoſe poſterity thoſe princes were deſcended, who firſt conquered the iſland of Sicily from the Saracens, and formed the preſent kingdom of Naples.

17 e Normans firſt own in ly.

18 They return and defeat the Greeks,

19 But are at laſt defeated by them.

In 1040, the Greek emperor Michael Paleologus, in order to ſecure the affection of his fickle ſubjects, undertook the conqueſt of Italy from the Saracens, and for that purpoſe ſent a general named *Michael Maniacus* into Sicily. This commander, hearing of the great reputation of the Normans, ſent to Guiamarius, prince of Salerno, intreating him to grant him ſome of thoſe warriors. His requeſt was moſt willingly hearkened to by the prince of Salerno, who, to encourage the Normans to engage in the expedition, promiſed them ſome additional rewards beſides the emperor's pay. William, Drogo, and Umbert, accordingly marched from Salerno with 300 of their countrymen; and paſſing over into Sicily, diſtinguiſhed themſelves moſt remarkably in the conqueſt of that iſland. Maniacus acknowledged, that the recovery of Meſſina was chiefly owing to their valour; and William with his Normans gained a complete victory over the Saracens before Syracuſe, where he killed the governor of the city in ſingle combat. Maniacus made himſelf maſter of Syracuſe, and almoſt entirely reduced the whole iſland; but being accuſed of treaſon, was next year carried priſoner to Conſtantinople. His ſucceſſor Doceanus, being

20 The Normans paſs over into Sicily.

Naples.

being a man of no abilities, quickly loſt the whole iſland except Meſſina, and treated his Norman auxiliaries with the utmoſt contempt. He would not allow them any ſhare of the booty; and even cauſed one Ardoin, a noble Lombard, and aſſociate and interpreter of the Normans, to be whipped round the camp, becauſe he refuſed to part with the horſe of a Saracen whom he had ſlain in ſingle combat. The conſequences of this tyrannical behaviour were very fatal to the Greeks. Ardoin ſoon after obtained leave to return to Italy under pretence of a vow, and all the Normans embarked at night along with him; but inſtead of going to Rome, Ardoin went immediately to Averſa, where he perſuaded count Rainulphus, ſovereign of that province, to join with him in the deſign he had formed of attacking the Greek provinces in Italy, which, he ſhowed him, would be an eaſy conqueſt, as the inhabitants ſubmitted with great reluctance to the Greeks, and the provinces were at that time almoſt entirely defenceleſs. Rainulphus approved of the ſcheme, and raiſed 300 ſoldiers, whom he ſent under 12 officers, to join the other Normans under the ſons of Tancred; and made an agreement with Ardoin, that the conqueſts ſhould be equally divided among the chief leaders. Their firſt enterpriſe was the reduction of Melphis, one of the ſtrongeſt cities in Puglia, which preſently ſurrendered; and they increaſed its fortifications ſo much, that it thenceforth became impregnable. Soon after this they made themſelves maſters of Venoſa, Aſcoli, and Lavello, with very little oppoſition. Doceanus, alarmed with the rapidity of their conqueſts, immediately left Sicily, and marched with his army into Puglia, where he attacked the invaders near the river Oliviento; but after a fierce engagement, he was obliged to retire with conſiderable loſs. The Greeks were ſoon after defeated a ſecond time at Cannæ; and in a third engagement, which happened near the river Ofanto, the army of Doceanus was entirely routed, and he himſelf obliged to fly to Bari. On this bad ſucceſs Doceanus was ordered to return to his command in Sicily, and another general was ſent with an army into Puglia. This new commander, however, had no better ſucceſs than his predeceſſor; for his army was entirely defeated in an engagement with the Normans, and he himſelf taken priſoner. Atenulphus, brother to one of the princes of Benevento, on whom the Normans had conferred the chief command, ſet at liberty the captive general without conſulting them, on receiving from him a conſiderable ſum of money. With this the Normans were ſo much diſpleaſed, that they deprived Atenulphus of his command, and beſtowed it on Argyrus, ſon to the late Mello, who had eſcaped from Conſtantinople, and now aſſumed the title of *duke and prince of Italy*. Before this time alſo Maniacus, whom we have formerly mentioned, had returned to Italy; and to ſtrike the greater terror into the revolted cities, had executed a number of people of all ages and ſexes with great inhumanity. Soon after this Maniacus openly rebelled againſt the Greek emperor Conſtantinus, and prevailed upon his own army to proclaim him emperor, beginning hoſtilities immediately againſt the Greek cities. Argyrus at the ſame time took Giovenazzo and beſieged Trani, and ſoon after beſieged Maniacus himſelf in Tarento; but he, being afraid of falling into the hands of the Normans, fled to Otranto, and from thence to Bulgaria, where, being entirely defeated by one of the emperor's generals, he was taken priſoner, and had his head ſtruck off.

21 Their conqueſts.

The Normans having now conquered the greateſt part of Puglia, proceeded to make a diviſion of their conqueſt, in which, after each commander had got his proper ſhare, the city of Melfis was left common to all, and appropriated as a place for aſſembling to conſult about the moſt important affairs of the nation. Argyrus alone was neglected in this diviſion; but he, having gained the favour of the emperor by expelling the rebel Maniacus from Italy, was by him created duke of Bari, on purpoſe to check the power of the Normans, with the title of *prince and duke of Puglia*. The Normans, however, were too powerful to be much awed by Argyrus, and behaved with great inſolence to the neighbouring princes; but as they could not be expelled by force, and were confirmed in their conqueſts by Henry II. emperor of Germany in 1047, the Greek emperor attempted to get rid of them, by ſending Argyrus with large ſums of money to bribe them to enter into his ſervice againſt the Perſians. But they, perceiving the ſnare, replied, that they were reſolved not to leave Italy unleſs they were expelled by force; upon which Argyrus made uſe of the ſame money in bribing the Puglians to aſſaſſinate theſe invaders. This brought on a maſſacre, in which greater numbers of Normans periſhed than had fallen in all the late wars. Argyrus attempted to take advantage of the confuſion produced by this maſſacre, but was defeated; after which he had recourſe to Pope Leo, beſeeching him to deliver Italy from theſe cruel tyrants: but this ſcheme proved ſtill more unſucceſsful than the others had been; for the pope himſelf was defeated and taken priſoner; and, in conſequence of the reſpect ſhowed him by the Normans, granted them, as a fief of the holy ſee, all the conqueſts they had made or ſhould make in Calabria and Sicily.

22 Great n[umbers of t]he maſſacr[ed].

23 They a[re] confirm[ed] by the p[ope] in all t[heir] conque[ſts].

Soon after this, the Norman power became extremely formidable; the famous Robert Guiſcard aſcended the throne in 1056. He made great progreſs in the conqueſt of Calabria, and reduced moſt of the cities which held for the Greeks in theſe parts. About the ſame time the counts of Capua were expelled from their territory; and the abbot Deſiderius mentions his having ſeen the children of Landulphus V. the laſt count, going about as vagabonds, and begging for their ſupport. The pope, alarmed by theſe conqueſts, excommunicated the Normans in wholeſale, pretending that they had ſeized ſome of the territories belonging to the church; but, by the pretended ſubmiſſion of Robert, he not only was perſuaded to take off the ſentence of excommunication, but to inveſt him with the provinces of Apulia, Calabria, and Sicily. After this, he continued the war againſt the Greeks with great ſucceſs. In 1071, in conjunction with his brother Roger, he conquered the iſland of Sicily, and gave the inveſtiture of the whole iſland to him with the title of *count*, reſerving to himſelf only the half of Palermo, Meſſina, and the valley of Demona. The like ſucceſs attended his arms againſt Salerno in 1074; but after this, having unadviſedly taken ſome places from the pope, he again fell under the ſentence of excommunication; yet he was reconciled to him in 1080, and received

24 Sicily c[on]quered [by] Robert Guiſca[rd].

Naples. received a second time the investiture of all his dominions. The next year he undertook an expedition against the Greeks; and though the emperor was assisted by a Venetian fleet, Robert made himself master of the island of Corfu, reduced Durazzo, and great part of Romania; insomuch that by the success of his arms, and his near approach to Constantinople, he struck an universal terror among the Greeks. But while Robert was thus extending his conquests, he was alarmed by the news of a formidable rebellion in Italy, and that the emperor Henry had taken the city of Rome, and closely shut up the pope in the castle of St Angelo. Robert therefore, leaving the command of the army to his son Boemund, returned to Italy, where he immediately dispersed the rebels, and released the pope, while his son gained a considerable victory over the Greeks. After this Robert made great preparations for another expedition into Greece, in order to second his son Boemund. Alexius Comnenus, who was about this time declared emperor by the Greek army, being assisted by the Venetian fleet, endeavoured to oppose his passage; but was entirely defeated, with the loss of a great many galleys. But a final stop was now put to his enterprises by his death, which happened in the island of Corfu in 1085.

Though the power of the Normans was thus thoroughly established in Italy and Sicily, and though the prince of Benevento was in 1130 invested by the the pope with the title of king of Sicily; yet by reason of the civil dissensions which took place among themselves, and the general confusion which reigned

25
And by the emperor of Germany.

in Italy in those ages, they were obliged, notwithstanding all their valour, to submit to the emperor in 1195. By him the Sicilians were treated with so great cruelty, that the empress Constantia was induced to conspire against him in 1197, took him prisoner, and released him only on condition of his sending off his army immediately for the Holy Land. This was complied with; but the emperor did not long survive the reconciliation, being poisoned, as was supposed, by order of the empress.

In 1254 the pope claimed the kingdom as a fief devolved on the church in consequence of a sentence of deposition pronounced against king Frederic at the council of Lyons; and, in 1263, the kingdom was, in consequence of this right, conferred on Charles count of Anjou. After much contention and bloodshed, the French thus became masters of Sicily and Naples.

26
The French become masters of Sicily and Naples.

Their government was insupportably tyrannical; and at the same time the haughtiness of their king so provoked the pope, that he resolved to humble him.—Charles had resolved on an expedition against Constantinople; and for this purpose had fitted out a fleet of 100 galleys, 30 large ships, 200 transports, besides many other smaller vessels, on board of which he intended to embark 10,000 horse, and a numerous army of foot. This formidable armament greatly alarmed the emperor Michael Paleologus; for which reason he entered into a negociation with John di Procida, a noble Salernitan, lord of the isle of Procida in the bay of Naples, who had formed a scheme for a general revolt in the island of Sicily. John, though a nobleman, was also a physician, and had been counsellor to two former princes, and even to king Charles himself; but being stripped of his estate by the king under pretence of treason, and his wife being debauched by the French, he retired to Constantia queen of Arragon, where he was created a baron of the kingdom of Valencia, by her husband king Peter, and Lord of Luxen, Benizzano, and Palma. As he was greatly exasperated against the French, he employed many spies both in Puglia and Sicily; and being informed that the Sicilians were totally disaffected to the French, he came to the island in disguise, and concerted a plan with the most powerful of the malcontents for a revolution in favour of Constantia, though she derived her right only as being the daughter of a former usurper named *Manfred*. Procida then set out for Constantinople, where, in some private conferences with the emperor, he persuaded him, that the most probable means of defeating Charles's scheme was by assisting the Spaniards and Sicilian malcontents. Paleologus accordingly granted him a large sum of money, and on his departure sent one of his secretaries along with him, who, landing in Sicily, had a conference with the chief conspirator. John, having received letters from them, disguised himself in the habit of a Franciscan, and went to Suriano in the neighbourhood of Rome. As he well knew the enmity which subsisted between the pope and king Charles, he disclosed his design to his holiness; who readily entered into his measures, wrote to Peter to hasten his armament, promising him the investiture of the island as soon as he had taken possession of it; and, by refusing the assistance he had promised to Charles, obliged him for the present to delay his expedition. In the beginning of the year 1280, Procida returned to Arragon, and by showing the letters from the pope and Sicilian barons, prevailed on Peter to embark in his design, by assuring him of the assistance of Paleologus. The king of Arragon accordingly prepared a formidable fleet under pretence of invading Africa, and is even said to have received 20,000 ducats from Charles, in order to assist him in his preparations.

But while John went on thus successfully with his scheme, all his measures were in danger of being broke by the death of pope Nicholas. The new pope, Martin IV. was entirely in the interest of Charles, on whom, in 1281, he conferred the senatorial dignity of Rome. Procida, however, still resolved to prosecute his scheme; and, leaving Italy, had another conference with the conspirators in Sicily; after which, he again went to Constantinople, and obtained from Paleologus 30,000 ounces of gold, with which he immediately returned to Arragon. The death of Nicholas had damped the ardour of Peter; but, being urged with great earnestness by John, he again renewed his preparations; which alarmed the pope and the king of France. In consequence of this they sent a message to him, desiring to know against what Saracens he designed to employ his armament. In this particular Peter refused to satisfy them; upon which they earnestly counselled Charles to guard against an invasion: but he neglected their advice, being wholly intent on his eastern expedition, and encouraged by a revolt which had happened in Greece; and to facilitate his expedition, he prevailed on the pope to excommunicate the Greeks, on pretence that they had broken some of the articles of union concluded at the council of Lyons a few years before. Peter in the mean time continued his

Naples.

27 They are maſſacred. his preparations with great diligence, intending to put to ſea the following ſummer. Procida had returned to Palermo, to wait for a favourable opportunity of putting his deſign in execution, which was ſoon afforded him by the French. On Eaſter Monday, March 30th, 1282, the chief conſpirators had aſſembled at Palermo; and, after dinner, both the Palermitans and French went in a grand proceſſion to the church of Monreale, about three miles without the city. While they were ſporting in the fields, a bride happened to paſs by with her train, who being obſerved by one Drochettus, a Frenchman, he ran to her, and began to uſe her in a rude manner, under pretence of ſearching for concealed arms. A young Sicilian, exaſperated at this affront, ſtabbed him with his own ſword; and a tumult enſuing, 200 French were immediately murdered. The enraged populace then ran to the city, crying out, "Let the French die, Let the French die;" and, without diſtinction of age or ſex, ſlaughtered all of that nation they could find, even ſuch as had fled to the churches. The conſpirators then left Palermo, and excited the inhabitants to murder the French all over the iſland, excepting in Meſſina, which city at firſt refuſed to be concerned in the revolt. But, being invited by the Palermitans to throw off the French yoke, a few weeks after, the citizens in a tumultuous manner deſtroyed ſome of the French; and pulling down the arms of king Charles, and erecting thoſe of the city, choſe one Baldwin for their governor, who ſaved the remaining French from the fury of the populace, and allowed them to tranſport themſelves, with their wives and children, to Italy. Eight thouſand perſons are ſaid to have been murdered on this occaſion.

Immediately after this maſſacre, the Sicilians offered their allegiance to the king of Arragon; who accepted of the invitation, and landed with his forces at Trapani. From thence he went to Palermo, where he was crowned king of Sicily with great ſolemnity, and Charles left the iſland with precipitation. The day after he landed his army in Italy, the Arragonian fleet arrived, took 29 of his galleys, and the next day burnt 80 tranſports in preſence of his army. Soon after this Charles ſent an embaſſy to Peter, accuſing him of perfidy, in invading his dominions in time of peace; and, according to ſome, challenged him at the ſame time to decide the matter by ſingle combat. Others ſay, that the challenge was given by Peter. Certain it is, however, that a challenge was given, and to appearance accepted: but Peter determined to employ much more effectual means in ſupport of his pretenſions than truſting to a duel; and therefore puſhed on his operations moſt vigorouſly, while his adverſary trifled away his time: and thus he at laſt became maſter of the conteſted kingdom; which, however, he did not long enjoy, dying about the end of the year 1285.

By his will, Peter left the kingdom of Arragon to his eldeſt ſon Alphonſus, and Sicily to Don James his other ſon, who was alſo to ſucceed to the kingdom of Arragon in caſe Alphonſus ſhould die without male iſſue. Accordingly, Don James was ſolemnly crowned at Palermo the 2d of February 1286. In 1295, however, he deſerted them, and tamely reſigned up his right to Charles, ſon to him above-mentioned, in a manner perhaps unparalleled. On his reſignation the Sicilians conferred the crown upon his brother Don Frederic: after which the war continued with great violence till the year 1303, when a peace was concluded, and the kingdoms of Naples and Sicily formally disjoined; Frederic being allowed to keep the latter, under the name of *Trinacria;* and Charles being confirmed in the poſſeſſion of the former, which he quietly enjoyed till his death in 1309. 28 The kingdoms of Naples and Sicily disjoined.

Naples continued to be governed by its own kings till the beginning of the 16th century, when the kings of France and Spain contended for the ſovereignty of this country. Frederic, at that time king of Naples, reſigned the ſovereignty to Louis XII. on being created duke of Anjou, and receiving an annual penſion of 30,000 ducats. But, in 1504, the French were entirely defeated by the Spaniards, and obliged to evacuate the kingdom; and the following year Louis renounced all pretenſions to the crown, which from that time hath remained almoſt conſtantly in the hands of the Spaniards. 29 The Spaniards become maſters of Naples.

The government of the Spaniards proved no leſs oppreſſive to the Neapolitans than that of others had been. The kings of Spain ſet no bounds to their exactions, and of conſequence the people were loaded with all manner of taxes; even the moſt indiſpenſable neceſſaries of life not being exempted. In 1647, a new tax was laid on fruit; which the people looked upon as the moſt grievous oppreſſion, the chief part of their ſubſiſtence, during the ſummer months, being fruit, which in the kingdom of Naples is very plentiful and delicious. The edict for collecting the new duty was no ſooner publiſhed, than the people began to murmur in a tumultuous manner; and when the viceroy came abroad, they ſurrounded his coach, bawling out to have their grievances redreſſed. They were encouraged in their ſedition, by the news that the citizens of Palermo had actually revolted on account of the impoſition of new duties. The viceroy, therefore, apprehenſive of greater diſorders, began to think of taking off the tax; but thoſe who farmed the tax having bribed ſome of his favourites, he was by their means perſuaded not to aboliſh it. The indignation of the people, who had ſuſpected his intention, was now greatly increaſed, eſpecially as they were privately excited by ſeveral malcontents. The farmers of the revenue, and all thoſe concerned in raiſing the taxes, had incurred the hatred and deteſtation of the people, particularly of Tommaſo Aniello, commonly called *Maſſaniello of Amalfi*, a fiſherman, whoſe wife, having been diſcovered in ſmuggling a ſmall quantity of meal, was impriſoned, and condemned to pay a fine of 100 ducats. 30 A general revolt. 31 Account of Maſſaniello.

Maſſaniello, a few years before, had come to Naples from Amalfi, where his father had been a fiſherman. At this time he was about 24 years of age, and the father of four children. He was of a middling ſtature, and an agreeable aſpect; was diſtinguiſhed for his boldneſs, activity, and integrity; and had a great influence with his companions, by whom he was beloved and eſteemed. As he was obliged even to ſell his furniture to pay the heavy fine, he had conceived an implacable hatred againſt the farmers of the taxes, and was alſo moved with compaſſion for the miſerable ſtate of the city and kingdom. He therefore formed a deſign, with ſome of his companions, to raiſe a tumult in the market-place on the feſtival-day of the Carmelites, uſually celebrated about the middle of July, when between

tween 500 and 600 youths entertain the people by a mock-fight; one half of them in the character of Turks, defending a wooden caſtle, which is attacked and ſtormed by the other half in the character of Chriſtians. Maſſaniello being appointed captain of one of theſe parties, and one Pione, who was privy to his deſign, commanding the other, for ſeveral weeks before the feſtival they were very diligent in reviewing and training their followers, who were armed with ſticks and reeds: but a ſmall and unforeſeen accident tempted them to begin their enterpriſe without waiting for the feſtival.

On the 7th of July a diſpute happening in the market-place betwixt the tax-gatherers and ſome gardeners of Pozzuolo who had brought ſome figs into the city, whether the buyer or ſeller ſhould pay the duty; after the tumult had continued ſeveral hours, Maſſaniello, who was preſent with his company, excited the mob to pillage the office built in the market for receiving the duty, and to drive away the officers with ſtones. The elect of the people, who, by deciding againſt the gardeners, had increaſed the tumult, ran to the palace, and informed the viceroy, who moſt imprudently neglected all means of putting a ſtop to the commotion. Maſſaniello, in the mean time, being joined by great numbers of people, ordered his young troop to ſet fire to all the offices for the taxes through the city; which command being executed with diſpatch, he then conducted them directly to the palace, where the viceroy, inſtead of ordering his Spaniſh and German guards to diſperſe them, encouraged their inſolence by timidly granting their demands. As they ruſhed into the palace in a furious manner, he eſcaped by a private door, and endeavoured to ſave himſelf in *Caſtel del Ovo*; but being overtaken by the rioters in the ſtreets, he was trampled upon by them, and pulled by the hair and whiſkers. However, by throwing ſome handfuls of gold among them, he again eſcaped, and took ſanctuary in a convent of Minims, where, being joined by the archbiſhop of Naples, cardinal Filomarini, and ſeveral nobles, by their advice he ſigned a billet, by which he aboliſhed all taxes upon proviſions. As a means to quell the tumult, he likewiſe deſired the cardinal to offer Maſſaniello a penſion of 2400 crowns, who generouſly rejected the bribe; and declared, that if the viceroy would keep his word, he would find them obedient ſubjects.

It was now expected that the tumult would ceaſe; but Maſſaniello, upon his return to the market-place, being joined by ſeveral malcontents, among whom were Genuino and one Peronne, who had formerly been a captain of the Sbirri, he was adviſed by them to order the houſes of thoſe concerned in raiſing the tax to be burned; which were accordingly in a few days reduced to aſhes, with all their rich furniture. Maſſaniello being now abſolute maſter of the whole city, and being joined by great numbers of people of deſperate fortunes, he required the viceroy, who had retired to the *Caſtel Nuovo*, to aboliſh all the taxes, and to deliver up the writ of exemption granted by Charles V. This new demand greatly embarraſſed the viceroy; but to appeaſe the people, he drew up a falſe deed in letters of gold, and ſent it to them by their favourite the duke of Matalone, who had before been in confinement. The fraud, however, being diſcovered, the duke was pulled from his horſe and maltreated by the mob, and at length committed as a priſoner to Peronne. This accident, to the great joy of the viceroy, enraged the people againſt the nobility, ſeveral of whom they killed, burnt the houſes of others, and threatened to extirpate them all. Maſſaniello, in the mean time, tattered and half naked, commanded his followers, who were now well armed, and reckoned about 100,000 men, with a moſt abſolute ſway. He eat and ſlept little, gave his orders with great preciſion and judgement, appeared full of moderation, without ambition and intereſted views. But the duke of Matalone having procured his liberty by bribing Peronne, the viceroy imitated his example, and ſecretly corrupted Genuino to betray his chief. A conſpiracy was accordingly formed againſt Maſſaniello by Matalone and Peronne; the duke, who was equally exaſperated againſt the viceroy, propoſing, that after his death his brother D. Joſeph ſhould head the rebels.

Maſſaniello in the mean time, by means of the cardinal archbiſhop, was negociating a general peace and accommodation; but while both parties were aſſembling in the convent of the Carmelites, the banditti hired by Matalone made an unſucceſsful attempt upon Maſſaniello's life. His followers immediately killed 150 of them. Peronne and D. Joſeph being diſcovered to be concerned in the conſpiracy, were likewiſe put to death, and the duke with great difficulty eſcaped. Maſſaniello by this conſpiracy was rendered more ſuſpicious and ſevere. He began to abuſe his power by putting ſeveral perſons to death upon ſlight pretences; and, to force the viceroy to an accommodation, he cut off all communication with the caſtles, which were unprovided with proviſion and ammunition. —The viceroy likewiſe being afraid leſt the French ſhould take advantage of the commotion, earneſtly deſired to agree to a treaty; which was accordingly concluded on the fifth day of the inſurrection, by the mediation of the archbiſhop. By the treaty it was ſtipulated, that all duties impoſed ſince the time of Charles V. ſhould be aboliſhed; that the writ of exemption granted by that emperor ſhould be delivered to the people; that for the future no new taxes ſhould be impoſed; that the vote of the elect of the people ſhould be equal to the votes of the nobility; that an act of oblivion ſhould be granted for all that was paſt; and that the people ſhould continue in arms under Maſſaniello till the ratification of the treaty by the king.

32
A treaty concluded between Maſſaniello and the viceroy.

By this treaty, no leſs than 10,000 perſons, who fattened upon the blood of the public, were ruined.— The people, when it was ſolemnly publiſhed, manifeſted an extreme joy, believing they had now recovered all their ancient rights and privileges. Maſſaniello, at the deſire of the viceroy, went to the palace to viſit him, accompanied by the archbiſhop, who was obliged to threaten him with excommunication, before he would conſent to lay aſide his rags and aſſume a magnificent dreſs. He was received by the duke with the greateſt demonſtrations of reſpect and friendſhip, while the ducheſs entertained his wife, and preſented her with a robe of cloth of ſilver, and ſome jewels.— The viceroy, to preſerve ſome ſhadow of authority, appointed him captain general; and at his departure made him a preſent of a golden chain of great value, which with great difficulty he was prevailed upon to accept;

33
Maſſaniello appointed captain-general.

Naples. accept; but yielded at length to the intreaties of the cardinal. Next day, in consequence of the commission granted him by the viceroy, he began to exercise all the functions of sovereign authority; and having caused a scaffold to be erected in one of the streets, and several gibbets, he judged all crimes, whether civil or military, in the last resort; and ordered the guilty to be immediately put to death, which was the punishment he assigned to all offences. Though he neglected all forms of law, and even frequently judged by physiognomy, yet he is said not to have overlooked any criminal, or punished any innocent person.

His grandeur and prosperity was of very short continuance; for his mind becoming distracted and delirious for two or three days, he committed a great many mad and extravagant actions; and on the 18th of July was assassinated with the consent of the viceroy.

34 Is assassinated.

The tumult did not end with the death of Massaniello: on the contrary, the people now expelled the Spaniards from most of the cities throughout the kingdom; and this general insurrection being the subject of discourse at Rome, the duke of Guise, who happened then to be at the pope's court, took the opportunity, at the instigation of his holiness, to offer his service to the Neapolitans against the Spaniards. The duke was prompted by his ambition to engage in this enterprise, especially as he himself had some distant pretensions to the crown. The Spaniards in the mean time made a vigorous attack on the city; but were repulsed by the people, who now formally renounced their allegiance to them. In a short time, however, their city being surprised by the new viceroy, the count d'Oniate, and the duke of Guise himself taken prisoner, the people returned to their allegiance; and thus all the attempts of the French on Naples were frustrated. Since that time the Spaniards continued in peaceable possession of the kingdom till the year 1707, when it was taken from them by prince Eugene. It was formally ceded to the emperor by the treaty of Rastadt in 1713; but was recovered by the Spaniards in 1734, and the king of Spain's eldest son is now king of Naples and Sicily. For a particular account of these revolutions, see the articles SPAIN and SICILY.

35 The people return to their allegiance.

36 Climate, produce, &c. of Naples.

The climate of Naples is extremely hot, especially in July, August, and September. In winter there is seldom any ice or snow, except on the mountains.—On account of its fertility, it is justly termed an earthly paradise; for it abounds with all sorts of grain, the finest fruit and garden-productions of every kind, with rice, flax, oil, and wine, in the greatest plenty and perfection. It affords also saffron, manna, alum, vitriol, sulphur, rock-crystal, marble, and several sorts of minerals, together with fine wool, and silk. The horses of this country are famous, and the flocks and herds very numerous. Besides these products, of which a considerable part is exported, there are manufactures of snuff, soap, and glass-ware. Waistcoats, caps, stockings, and gloves, are also made of the hair or filaments of a shell-fish, which are warmer than those of wool, and of a beautiful glossy green. In this kingdom likewise is found that called the *Phrygian stone*, or *pietra fungifera*, which, being laid in a damp shady place, will yield mushrooms, sometimes of a very large size, especially if the stone is sprinkled with hot water. See AGARICUS.

As to the mountains of this country, the principal are those of the Apennine, which traverse it from south to north; and Mount Vesuvius, which, as is well known, is a noted volcano, five Italian miles from Naples. The side of this mountain next the sea yields wine, particularly the two famed wines called *Vino Greco* and *Lachrymæ Christi*. One of the greatest inconveniencies to which this kingdom is exposed is earthquakes, which the eruptions of Mount Vesuvius contribute, in some measure, to prevent. Another inconveniency, which, however, is common to it with other hot countries, is the great number of reptiles and insects, of which some are very poisonous.

37 Religion.

With respect to religion, it is on a very bad footing here. The number of convents and monasteries is astonishing. It is said, the clergy and convents possess two thirds of the whole kingdom: nay, some maintain, that were the kingdom divided into five parts, four would be found in the hands of the church. Notwithstanding this power and influence of the clergy, they have not been able hitherto to get the inquisition established here. In the year 1731, measures were taken for lessening the number of convents; and lately the order of Jesuits hath been suppressed. The papal bulls cannot be made public without the king's permission; nor are Protestants compelled to kneel in the churches, or at meeting the host; and in Lent they can very easily procure flesh meat. In the year 1740, the Jews were allowed to settle in the kingdom during the term of 50 years, and several privileges were granted them during that period; at the expiration of which, the grant was supposed to be renewed, unless they were expressly ordered to quit the country.

38 Revenue, &c.

The revenue of the kingdom is generally computed at 3,000,000 of crowns: but, as Mr Addison observes, there is no country in Europe which pays greater taxes, and where, at the same time, the public is less the better for them, most of them going to the enriching of the private persons to whom they are mortgaged.

The military force of this kingdom is said to consist of about 30,000 men, of which the Swiss regiments are the best. As to the marine, it consists only of a few galleys. The only order here is that of St Januarius, which was instituted by Don Carlos in the year 1738.

The king of Naples, or of the two Sicilies, is an hereditary monarch. The high colleges are the council of state, the privy-council, the treasury, the Sicily-council, the council of war, &c. This kingdom is a papal fief; and the king, in acknowledgment of the pope's feudal right, sends him every year a white palfry, and a purse of 6000 ducats. The title of the king's eldest son is *prince of Calabria*. The number both of the high and low nobility in the kingdom of Naples is very great. "I am assured (says Dr Moore§) that the king of Naples counts among his subjects 100 persons with the title of prince, and a still greater with that of duke. Six or seven of these have estates which produce from 10 to 12 or 13,000 l. a year; a considerable number have fortunes of about half the value; and the annual revenue of many is not above 1000 l. or 2000 l. The inferior orders of the nobility are much poorer. Many counts and marquisses have not above 300 l. or 400 l. a year of paternal estate; many have still less; and not a few enjoy the title without any estate whatever. These nobles, however, are excessively

§ *View of Society, &c. in Italy.*

Naples.

excessively fond of splendor and show, which appears in the brilliancy of their equipages, the number of their attendants, the richness of their dress, and the grandeur of their titles. The finest carriages are painted, gilt, varnished, and lined, in a richer and more beautiful manner than has yet become fashionable either in England or in France. They are often drawn by six and sometimes by eight horses. Before the carriage, it is the mode to have two running footmen, and behind three or four servants in the richest liveries. The ladies and gentlemen within the coaches glitter in all the brilliancy of lace, embroidery, and jewels.— This finery is not confined to the persons within and without the coaches; it is extended to the horses, whose heads, manes, and tails, are ornamented with the rarest plumage, and set off with ribbon and artificial flowers."

We shall mention a circumstance from which an idea may be formed of the grandeur of a Neapolitan palace, and the number of domestics which some of the nobility retain. "I dined (continues our author) at the prince Iacci's, where we passed through 12 or 13 large rooms before we arrived at the dining-room. There were 36 persons at table served by the prince's domestics, and each guest had a footman behind his chair, while other domestics belonging to the prince remained in the adjacent rooms and in the hall. No estate in England could support such a number of servants, paid and fed as English servants are; but in Naples the wages are very moderate indeed, and the greater number of men-servants, belonging to the first families, give their attendance through the day only, and find beds and provisions for themselves. It must be remembered also, that few of the nobles give any entertainments; and those who do not are said to live very sparingly; so that the whole of their revenue, whatever it may be, is expended on articles of show."

In the kingdom of Naples, the hereditary jurisdiction of the nobles over their vassals subsists in the full rigour of the feudal government. The peasants therefore are poor; and it depends entirely on the personal character of the master, whether their poverty be not the least of their grievances. As this power is too often abused, the importance of the nobility depends in a great measure on the favour of the king, who, under pretence of any offence, can confine them to their estates, or imprison them at pleasure. Unless this prince were so very impolitic as to disgust all the nobility at once, and so unite the whole body against him, he has little to fear from their resentment. Even in case of such an union, as the nobles have lost the affection of their vassals, what could they do in opposition to a standing army of 30,000 men, entirely devoted to the crown? The government of Naples, therefore, is in fact a despotic monarchy, though something like the form of a feudal constitution in its ancient purity is still kept up by the biennial summons of the general assembly. This convention, which consists of the nobility and commons, is called together every two years, to deliberate on the customary free-gift to the crown.

The inhabitants of this country have at all times borne but an indifferent character among other nations. "From the few hints dropped by the classic authors, we collect that the ancient Neapolitans were a race of Epicureans, of a soft indolent turn, averse from martial exercises, passionately fond of theatrical amusements and music, expert in all the refined arts that administer to the caprices of luxury, extravagant in their expressions and gestures, and dupes to various sorts of superstition. If we make allowance for a quantity of northern blood which has joined the original Grecian stream, and imparted a roughness not yet worn off by the mildness of the climate, we shall find the modern Neapolitans very like the ancient.— Provisions being here plentiful and cheap, the lower class of people work but little. Their delight is to bask in the sun, and do nothing. Persons of a middle rank frequent places of public resort; and very few of any rank attend to their proper business with the zeal and activity we are wont to meet with in the professional men of colder countries. Gluttony is a predominant vice, while instances of ebriety are comparatively rare. In the female sex, the passion for finery is almost superior to every other; and, though chastity is not the characteristic virtue of the country, Mr Swinburne doubts § whether a Neapolitan woman would not nine times out of ten prefer a present to a lover. That furious jealousy for which the nation was once so remarkable, is now greatly abated. The breach of the conjugal vow sometimes occasions quarrels and assassinations among people of an inferior station; and in the metropolis, assassinations are often perpetrated from much less cogent motives. Of these vices, many are doubtless owing to that slavery and oppression under which they groan, and to a radical defect in the administration of justice, though the kingdom is divided into 12 provinces or jurisdictions.

§ *Travels in the Two Sicilies.*

Naples, anciently *Parthenope*, afterwards *Neapolis*, the capital of the kingdom of that name in Italy, lies in the province called *Terra di Lavora*, which is the richest and best inhabited of the whole kingdom, and comprehends a part of the ancient Campania Felix, or the Happy. This city is fabled to owe its foundation to a syren, and to have received its ancient name from its supernatural foundress. Whatever be its origin, it is the first for neatness, and the second for extent, of all the cities in Italy. It was formerly a place of strength; but its walls at present being of no real defence, its safety depends of course upon the force of its armies. It is most advantageously situated, having a delicious country on one side, and a noble bay of the Mediterranean on the other, with an excellent harbour. The circumference, including the suburbs, is said not to be less than 18 Italian miles, and the number of the inhabitants therein little less than 400,000. The houses are of stone, flat-roofed, and generally lofty and uniform; but many of them have balconies, with lattice-windows. The streets are well paved; but they are not lighted at night, and in the day-time are disfigured, in many places, by stalls, on which provisions are exposed to sale. Here are a great number of fine churches, convents, fountains, and palaces of the nobility, many of whom constantly reside here. It is usual to walk on the tops of the houses in the evenings, to breathe the sweet cool air, after a hot sultry day. The climate here is so mild and warm, even in the winter, that plenty of green pease, artichokes, asparagus, and other vegetables, may

Naples.

may be had ſo early as the beginning of the new year, and even all the winter. This city ſwarms with monks and nuns of all ſorts, to ſuch a degree, that there are no leſs than 19 convents of the Dominicans alone, 18 of the Franciſcans, 8 of the Auguſtines, and an equal proportion of the reſt. The magnificence of many of the churches exceeds imagination. In a cloyſter of the Carthuſian monaſtery is a crucifix, ſaid to be done by Michael Angelo, of inimitable workmanſhip.

To repel hoſtile attempts by ſea, which, from its ſituation, maritime powers might be tempted to make, Naples has, to the weſt, the Caſtel del Uovo, a confuſed pile of ancient buildings, and ſome modern batteries. The rock upon which this fortreſs ſtands was originally called *Megara*, then *Lucullanum*, and was conſidered as a place of ſtrength ſo early as in the year 475. Along the line of the ſhore towards the eaſt are ſome batteries on the points of land, the baſtions of the arſenal, and above it the lofty wall of the Caſtel Nuovo. This laſt fortreſs has been the uſual refuge of the ſovereigns and viceroys in all civil wars and tumults; for which reaſon they have long fixed their reſidence near its walls. A block-houſe and batteries defend the mouth of the harbour, and at the eaſtern extremity of the town is the Torrione de Carmine, better known by the figure it made in Maſſaniello's rebellion than by its extent or military ſtrength. The caſtle of Saint Elmo commands Naples in every direction, and is in reality calculated rather to annoy and awe the citizens than to defend them from foreign invaders. The city is indeed far from being ſecure againſt a bombardment; for the ſea is ſo deep, that a large veſſel may come up to the very mole in defiance of the block-houſe and batteries, &c. Pictures, ſtatues, and antiquities, are not ſo common in Naples as might be expected in ſo great and ancient a city, many of the moſt valuable pieces having been ſent to Spain by the viceroys. The bay is one of the fineſt in the world, being almoſt of a round figure, of about 30 miles in diameter, and three parts of it ſheltered with a noble circuit of woods and mountains. The city ſtands in the boſom of this bay, in as pleaſant a ſituation, perhaps, as in the world. Mr Keyſler ſays, they reckon about 18,000 *donne libere*, or courtezans in the city, and Dr Moore computes the number of *lazzarani* or blackguards at above 30,000. The greater part of theſe wretches have no dwelling-houſes, but ſleep every night under porticos, piazzas, or any kind of ſhelter they can find. Thoſe of them who have wives and children, live in the ſuburbs of Naples near Peuſilippo, in huts, or in caverns or chambers dug out of that mountain. They are generally repreſented as a lazy, licentious, and turbulent ſet of people, as indeed by far the greater of the rabble are, who prefer begging or robbing, or running errands, to any fixed and permanent employmrnt. Yet there are in Naples ſome flouriſhing manufactures, particularly of ſilk ſtockings, ſoap, ſnuff-boxes of tortoiſe ſhells and the lava of Mount Veſuvius, tables, and ornamental furniture of marble. The city is ſupplied with a vaſt quantity of water, by means of a very coſtly aqueduct, from the foot of Mount Veſuvius. Mr Addiſon ſays, it is incredible how great a multitude of retainers to the law there are in Naples, who find continual employment from the fiery temper of the inhabitants. There are five piazzas or ſquares in the city, appropriated to the nobility, viz. thoſe called *Capuana*, *Nido*, *Montagna*, *Porto*, and *Porta Nova*. Of all the palaces, that of the king is not only the moſt magnificent, but alſo in the beſt ſtyle of architecture. The cathedral, though Gothic, is a very grand ſplendid edifice. It is here that the head and blood of St Januarius, the tutelary ſaint of Naples, are kept, the latter in two glaſs or cryſtal vials. The pretended liquefaction of the dried blood, as ſoon as brought near the head of the ſaint, is a thing well known; Mr Addiſon ſays, it is one of the moſt bungling tricks he ever ſaw†. The harbour is ſpacious, and kept in good repair. It is fortified with a mole, which runs above a quarter of a mile into the ſea, and at the extremity has a high lantern to direct ſhips ſafely into the harbour. Luxury here is reſtrained by ſevere ſumptuary laws, and the women are more cloſely confined than in any other city of Italy. Here is an univerſity and two academies of wits, the one called *Gli Ardenti*, and theother *Gli Otioſi*. The nunnery for ladies of quality is ſaid to be the largeſt in the whole world, containing no leſs than 350 nuns, beſides ſervants. The Mount of Piety, or the office for advancing money to the poor, on pledges, at a low intereſt, or without any, has an income of upwards of 50,000 ducats. The arſenal is ſaid to contain arms for 50,000 men. The walls of the city conſiſt of hard black quarry ſtones, called *piperno*.—Inſtead of ice, vaſt quantities of ſnow are uſed for cooling their liquors, not ſo much as water being drank without it; ſo that, it is ſaid, a ſcarcity of it would as ſoon occaſion a mutiny as a dearth of corn or proviſions. Certain perſons, who farm the monopoly of it from the government, ſupply the city all the year round from a mountain about 18 miles off, at ſo much the pound. Naples ſtands 110 miles ſouth-eaſt from Rome, 164 north-eaſt from Palermo in Sicily, 217 ſouth-eaſt from Florence, and 300 from Venice. E. Long 14. 20. N. Lat. 40. 55.

† See Chemiſtry, n° 800.

NARBO (anc. geog.), a town of the Volcæ Tectoſages, called alſo *Narbo Martius*, from the Legio Martia, the colony led thither 59 years before the conſulate of Cæſar, (Velleius); increaſed with a colony of the Decumani or tenth legion by Cæſar. An ancient trading town on the Atax, which diſcharges itſelf into the ſea through the Lacus Rubreſus, or Rubrenſis. Capital of the Gallia Narbonenſis; ſurnamed *Colonia Julia Paterna*, from Julius Cæſar, the father of Auguſtus by adoption. Now called *Narbonne*, a city of Languedoc.

NARBONNE, is a city of France in Lower Languedoc, with an archbiſhop's ſee, and is particularly famous for its honey. It is ſeated on a canal cut from the river Aude, which being but three miles from the ſea, veſſels come up it laden with merchandiſe, which renders it a place of ſome trade. But though it pretends to the moſt remote antiquity under the Celtic kings, in ages anterior even to the Roman conqueſts, which under theſe latter maſters gave its name to all the *Gallia Narbonenſis*, and was a colony of the firſt conſideration, it is now dwindled to a wretched ſolitary town, containing ſcarce 8000 inhabitants, of whom three fourths are prieſts and women. The ſtreets and buildings are mean and ruinous; it has indeed a commu-

nication with the Mediterranean, from which Narbonne is only about three leagues diftant, by means of a fmall river which interfects the place; but their commerce is very limited, and chiefly confifts in grain which they export to Cette and Marfeilles. No marks of Roman magnificence remain, except feveral infcriptions in different parts of the city. It is divided into the city and the town, which are joined together by a bridge, with houfes on each fide, in which the richeft merchants live. There are feveral churches and convents, and the metropolitan church has a handfome fteeple. E. Long. 2. 6. N. Lat. 43. 11.

NARCISSUS, in fabulous hiftory, the fon of the river Cephiffus and Liriope the daughter of Oceanus, was a youth of great beauty. Tirefias foretold that he fhould live till he faw himfelf. He defpifed all the nymphs of the country; and made Echo languifh till fhe became a mere found, by refufing to return her paffion: but one day coming weary and fatigued from the chace, he ftopped on the bank of a fountain to quench his thirft; when, feeing his own form in the water, he became fo in love with the fhadowy image, that he languifhed till he died. On which the gods, being moved at his death, changed him into the flower which bears his name.

Narcissus, in botany: A genus of the monogynia order, belonging to the hexandria clafs of plants; and in the natural method ranking under the 9th order, *Spathaceæ*. There are fix petals; the nectarium is funnel-fhaped, and monophyllous; the ftamina are within the nectarium. The moft remarkable fpecies are,

1. The baftard narciffus, or common yellow Englifh daffodil, grows wild in great plenty in many of our woods and coppices, and under hedges in feveral parts of England. In the counties round London the herbfolks bring prodigious quantities in the fpring of the year, when in bloom, root and all, and fell them about the ftreets. Its commonnefs renders it of but little efteem with many; confidered, however, as an early and elegant flower, of exceeding hardinefs and eafy culture, it merits a place in every garden.

2. The bicolor, or two-coloured incomparable narciffus, hath a large, oblong, bulbous root; crowned with long, narrow, dark-green leaves, 12 or 14 inches long; an upright flower-ftalk, about 15 inches high, terminated by an uniflorous fpatha, protruding one large flower with white petals, and a bell-fhaped, fpreading, golden nectarium, waved on the margin, and equal in length with the corolla; flowering in April. The varieties are, common fingle-flowered—femi-double-flowered, with the interior petals fome white and fome yellow—with fulphur-coloured flowers.

3. The poeticus, poetic daffodil, or common white narciffus, is well known. Of this there are varieties with purple-cupped flowers—yellow-cupped flowers—double-flowered: all of them with entire white petals. It is the ancient celebrated narciffus of the Greek and Roman poets, which they fo greatly extol for its extreme beauty and fragrance.

4. The bulbocodium, hath a fmall bulbous root, crowned with feveral narrow, fubulate, rufh-like leaves, fix or eight inches long; amidft them a flender, taper flower-ftalk, fix inches high, terminated by an uniflorous fpatha, protruding one yellow flower, having the nectarium much larger than the petals, and very broad and fpreading at the brim; flowering in April. From the large fpreading nectarium of this fpecies, which being three or four times longer than the petals, narrow at bottom, and widening gradually to the brim, fo as to refemble the fhape of fome old-fafhioned hoop-petticoats, it obtained the name *hoop-petticoat narciffus*.

5. The ferotinus, or late-flowering fmall autumnal narciffus, hath a fmall bulbous root; crowned with a few narrow leaves; amidft them a jointed flower-ftalk, eight or nine inches high, terminated by an uniflorous fpatha, protruding one white flower, having a fhort, fix-parted, yellow nectarium; flowering in autumn.

6. The tazetta, or multiflorous daffodil, commonly called *polyanthus narciffus*, hath a very large, roundifh, bulbous root; long, narrow, plane leaves; an upright flower-ftalk, rifing from 10 or 12 inches to a foot and a half high; terminated by a multiflorous fpatha, protruding many large, fpreading, white and yellow flowers, in a clufter, having bell-fhaped nectariums fhorter than the corolla; flowering in February, March, and April, and is very fragrant. The varieties of this are very numerous, confifting of about eight or nine principal forts, each of which having many intermediate varieties; amounting in the whole greatly above an hundred in the Dutch florifts catalogues, each variety diftinguifhed by a name according to the fancy of the firft raifer of it. They are all very pretty flowers, and make a charming appearance in the flower-borders, &c. they are alfo finely adapted for blowing in glaffes of water, or in pots, to ornament rooms in winter.

7. The jonquilla, or jonquil, fometimes called *rufh-leaved daffodil*, hath an oblong, bulbous, brown root; fending up feveral long, femi-taper, rufh-like, bright-green leaves; amidft them an upright green flower-ftalk, a foot or 15 inches high; terminated by a multiflorous fpatha, protruding many yellow flowers, often expanded like a radius, each having a hemifpherical, crenated nectarium, fhorter than the petals; flowering in April, and moftly of a fine fragrance. The varieties are, jonquil minor with fingle flowers—jonquil major with fingle flowers—ftarry flowered—yellow and white flowered—white-flowered—femi-double-flowered—double-flowered—and large double inodorous jonquil: all of them multiflorous, the fingle in particular; but fometimes the doubles produce only two or three flowers from a fpatha, and the fingles commonly fix or eight. All the forts have fo fine a fhape, fo foft a colour, and fo fweet a fcent, that they are fome of the moft agreeable fpring-flowers.

8. The calathinus, or multiflorous yellow narciffus, hath a large bulbous root; crowned with long, narrow, plane leaves; and amidft them an erect, robuft flower-ftalk, terminated by a multiflorous fpatha, protruding many large, entire, yellow flowers, having a bell-fhaped, flightly crenated nectarium, equal in length with the petals.

9. The odorus, odoriferous, or fweet-fcented ftarry yellow narciffus, hath a bulbous root; narrow leaves; erect flower-ftalk, a foot or more high, terminated by a fub-multiflorous fpatha, protruding fometimes but

one,

one, and sometimes several entirely yellow flowers, having a campanulated, six-parted, smooth nectarium, half the length of the petals.

10. The triandrus, or triandrous rush-leaved white narcissus, hath a bulbous root; very narrow, rush-like leaves; erect flower-stalk, terminated by an uniflorous spatha, protruding one snowy-white flower, having a bell-shaped, crenated nectarium, half the length of the petals, and with mostly triandrous or three stamina.

11. The trilobus, or trilobate yellow narcissus, hath a bulbous root; narrow rush-like leaves; erect flower-stalks, terminated by a sub-multiflorous spatha, protruding sometimes but one or two, and sometimes several, yellow flowers, having a bell-shaped, three-lobed nectarium, half the length of the petals.

12. The minor, or yellow winter daffodil, hath a small bulbous root; plane leaves, eight or ten inches long, and more than half a one broad; an erect flower-stalk, terminated by an uniflorous spatha, protruding one nodding yellow flower, with spear-shaped petals, having an obconic, six-parted, waved nectarium, equal to the length of the corolla; flowering in winter, or very early in spring.

All these 12 species of narcissus are of the bulbous-rooted tribe, and universally perennial in root, but annual in leaf and flower-stalk; all of them rising annually in spring, immediately from the crown of the bulb, first the leaves, and in the midst of them the flower-stalk, one only from each root, entirely naked or leafless, each terminated by a spatha or sheath, which opens on one side to protrude the flowers, and then withers; the flowers, as before observed, are all hexapetalous, each furnished with a nectarium in the centre, and are universally hermaphrodite: they are large and conspicuous, appearing mostly in the spring-season, generally from March or April until June, succeeded by ripe seed in July; then the leaves and flower-stalks decay, and the roots desist from growing for some time; at which period of rest is the only proper time to take up or transplant the roots from one place to another, or to separate the offsets; for they all multiply abundantly by offset young bulbs from the main root, insomuch that a single bulb will in one or two years be increased into a large cluster of several bulbs, closely placed together, and which every second or third year should be taken up at the above period in order to be separated; and each offset so separated commences a distinct plant; which being planted again in autumn, produces flowers the following summer, alike in every respect to those of their respective parent bulbs. All the species are so hardy that they prosper in any common soil of a garden; observing, however, to allow the finer sorts of *polyanthus narcissus*, in particular, principally a warm dry situation; all the others may be planted any where in the open dry borders and flower-beds.

NARCOTICS, in medicine, soporiferous drugs, which bring on a stupefaction. Among narcotics the most eminent are those usually prepared for medicinal uses from the poppy, especially opium; as also all those prepared from mandragoras, hyoscyamus, stramonium, and datura.

NARDO, a pretty populous town in the kingdom of Naples, and in the Terra d'Otranto, with the title of a duchy and a bishop's see. E. Long. 18. 27. N. Lat. 43. 28.

In this little city are 8000 inhabitants. The steeple of its cathedral is built in a very uncommon but showy style of Gothic architecture. Luca Giordano and Solimeni have adorned the church with some agreeable paintings. This place was part of the Balzo estate. The Aquavivas were the next possessors: they are thought to have come from the Marca di Ancona. In 1401, in consideration of their relationship to Pope Boniface IX. Laudislaus erected their manor of Atri into a dukedom, an honour till then seldom granted to any but princes of the blood royal. Claudius Aquaviva, a famous general of the Jesuits, who died in 1615, was of this family.

NARDUS, in botany: A genus of the monogynia order, belonging to the triandria class of plants; and in the natural method ranking under the 4th order, *Gramina*. There is no calyx; the corolla is bivalved.

This plant was highly valued by the ancients, both as an article of luxury and medicine. The *unguentum nardinum* was used at baths and feasts as a favourite perfume. Its value is evident from that passage of scripture, where our Saviour's head was anointed with a box of it, with which Judas found fault. From a passage in Horace it appears that this ointment was so valuable among the Romans, that as much as could be contained in a small box of precious stone was considered as a sort of equivalent for a large vessel of wine, and a proper quota for a guest to contribute at an entertainment, according to the ancient custom:

——— *Nardo vina merebere,*
Nardi parvus onyx eliciet cadum.

The plant had a great character among the ancients as a medicine, both internally taken and externally applied. It has a place in the list of all antidotes from those of Hippocrates (given on the authority of Myrepsus and Nicholaus Alexandrinus) to the officinals which have kept their ground till lately, under the names of *Mithridate* and *Venice treacle*. Galen and Alexander Trallian recommend it in the dropsy and gravel; Celsus and Galen in pains of the stomach and bowels, both internally given and externally applied. Galen prescribed the oleum nardinum to the emperor Marcus Aurelius when afflicted with a cholera morbus. It was externally applied to the stomach on wool; and the success was so great, that he ever afterwards enjoyed the highest confidence of that emperor. In a work attributed to Galen, also, it is mentioned that a medicine composed of this and some other aromatics was found useful in long protracted fevers; and the natives of India at present consider it as a very efficacious remedy in fevers. Its sensible qualities, indeed, promise it to be of considerable efficacy in some cases, as it has a pungency of taste superior to contrayerva, and little inferior to serpentaria.

But though the name of this plant, with the uses and virtues of it, has long been familiar in the writings of botanists and physicians, the genus and species of the plant have only been ascertained very lately. In the Philosphical Transactions for 1790, Dr Blane gives an account of it from a letter sent him by his brother from Lucknow, dated in December 1786.— According to this gentleman's relation, being one day

on

Nardus.

on a hunting party with the nabob vifier, after crofsing the river Rapty, about 20 miles from the foot of the northern mountains, he was furprifed to find the air perfumed with an aromatic fmell, which, as he was told, proceeded from the roots of the grafs that were bruifed or torn out of the ground by the nabob's elephants and horfes. The country was wild, uncultivated, and entirely covered with this kind of grafs, which grew in large tufts clofe to each other, and from three to four feet long. As none of it was in flower, it being then the winter feafon, and the grafs having befides been burnt down by order of the nabob, our author caufed fome of the roots to be dug up, in order to plant it in his garden at Lucknow.—Here it profpered exceedingly; and fhot up fpikes to the height of fix feet. A fpecimen was fent to Sir Jofeph Banks, who found it to belong to the genus of andropogon, different from any fpecies hitherto defcribed by botanifts. "There is great reafon, however (fays Dr Blane), to think that it is the true nardus Indica of the ancients; for, 1. The circumftance of its difcovery correfponds in a ftriking manner with an occurrence related by Arrian in his Hiftory of Alexander's Expedition into India. During the march of that hero through the defarts of Gedrofia, the air was perfumed by the fpikenard, which was trampled under foot by the army; and the Phœnicians, who accompanied them, collected great quantities of it, as well as of myrrh, to carry them into their own country to make merchandife of them. This laft circumftance feems further to afcertain it to have been the true nardus; for the Phœnicians, who even in war appear to have retained their true genius for commerce, could no doubt diftinguifh the proper quality of this commodity. I am informed by major Rennel, that Gedrofia anfwers to the modern Mackran, or Kedgemackran, a maritime province of Perfia, fituated between Kermon (the ancient Carmania), and the river Indus, being of courfe the frontier province of Perfia towards India; and that it appears from Arrian's account, and from a Turkifh map of Perfia, that this defart lies in the middle tract of country between the river Indus and the Perfian gulf, and within a few days march of the Arabian or Erythræan fea. By this the ancients meant the northern part of the Ethiopic ocean, which wafhes the fouthern coafts of Arabia and Perfia; not what we now call the Red Sea, as its name would feem to imply, for this by the ancients was called the *Arabian Gulf.* 2. Though the accounts of the ancients concerning this plant are very defective, it is plain that it was of the natural order of gramina; for the term *arifta*, fo often applied to it, was appropriated by them to the fructification of grains and graffes, and feems to be a word of Greek original, to denote the moft excellent portion of thofe plants, which are the moft ufeful in the vegetable creation for the fuftenance of animal life; and nature has alfo kindly made them the moft abundant in all parts of the habitable earth. Galen fays, that though there are various forts of nardus, the term ναρδου σταχυς, or *fpikenard*, fhould not be applied to any but the nardus Indica. It would appear that the nardus Celtica was a plant of a quite different habit, and is fuppofed to have been a fpecies of valeriana.

"The defcription of the Nardus Indica by Pliny does not indeed correfpond with the appearance of our fpecimen; for he fays it is *frutex radice pingui et craffa*, whereas ours has fmall fibrous roots. But as Italy is very remote from the native country of this plant, it is reafonable to fuppofe that others more eafily procurable ufed to be fubftituted for it; and the fame author fays, that there were nine different plants by which it could be imitated and adulterated. There is a *Nardus Affyria* mentioned by Horace; and Diofcorides mentions the *Nardus Syriaca* as a fpecies different from the *Indica*, which certainly was brought from fome of the remote parts of India; for both Diofcorides and Galen, by way of fixing more particularly the country from whence it came, call it the *Nardus Gangites.* 3. *Garcias ab Horto*, a Portuguefe who refided many years at Goa in the 16th century, has given a figure of the roots, or rather of the lower parts of the ftalks, which correfponds with our fpecimen; and he fays that there is but this one fpecies of nardus known in India, either for the confumption of the natives, or for exportation to Perfia and Arabia. 4. The fenfible qualities of this are fuperior to what commonly paffes for it in the fhops, being poffeffed both of more fragrancy and pungency, which feems to account for the preference given to it by the ancients.

"There is a queftion, concerning which Matthiolus, the commentator of Diofcorides, beftows a good deal of argument, viz. whether the roots or ftalks were the parts efteemed for ufe, the teftimony of the ancients themfelves on this head being ambiguous. The roots of this fpecimen are very fmall, and poffefs fenfible qualities inferior to the reft of the plant; yet it is mentioned in the account above recited, that the virtues refide principally in the hufky roots. It is evident, that by the hufky roots muft here be meant the lower parts of the ftalks and leaves, where they unite to the roots; and it is probably a flight ambiguity of this kind that has given occafion to the ambiguity that occurs in the ancient accounts."

The fenfible qualities of this plant do not depend upon an effential oil, but on fome fixed principle like thofe of cardamoms or ginger. Dr Blane tried to extract its virtues with boiling water, maceration in wine or proof fpirits; but it yielded them fparingly and with difficulty to any of thefe menftrua. The Indians gave an infufion of it in hot water, with a fmall quantity of black pepper as a febrifuge.

Nardus, Narea.

NAREA, the moft foutherly province of the empire of Abyffinia; a kingdom ftill governed by its own princes, who have the title of *Beneros.* Its territory was formerly more extenfive than at prefent, the Galla having almoft quite furrounded it, efpecially on the fouth-eaft and north. The country to the weft is the moft unknown part of Africa; the kingdom itfelf ftands like a fortified place in the middle of a plain, being an high and mountainous country. A great many rivers, rifing in the fourth and fifth degrees of north latitude, fpread themfelves over the level part of the country, and fill it with marfhes all the way from fouth by eaft to north, or north-weft.—Thefe marfhes are bounded by mountains, of which thofe neareft the marfhes are overgrown with coffee trees, the largeft, if not the only ones, which grow in this country. The kingdom of Narea Proper is interfperfed with fmall, unwholefome, but very fertile

valleys,

Narea, Narration.

valleys. The mountainous country of Caffa adjoins immediately to Narea, and is ſaid to be governed by a ſeparate prince; but the Galla having ſettled themſelves in all the flat ground to the very edge of the marſhes, have in a great meaſure cut off the communication with Abyſſinia for a long time paſt. The Nareans who inhabit the mountainous country have the lighteſt complexion of any people in Abyſſinia; but thoſe who inhabit the borders of the marſhes are perfectly black, and have the features and woolly heads of negroes; but the mountaineers of Narea, and much more thoſe of Caffa, are fair-complexioned, more ſo than even the Neapolitans or Sicilians. It is ſaid that ſnow has been ſeen to lie on ſome of the mountains of Caffa; but Mr Bruce imagines this to be a miſtake, and thinks that it muſt have been hail.

Narea abounds with cattle, grain, and all kinds of proviſions, both in the high and low country. The medium of commerce is gold, which they ſell by weight; but the principal articles of trade are coarſe cotton cloths, antimony, beads, and incenſe, which are carried from this country to the kingdom of Angola, and the parts of the African continent towards the Atlantic. The people are exceedingly brave; and though they have been driven out of the low country by multitudes of Galla, they now bid them defiance, and drive them from their frontiers whenever they come too near. The Narean priſoners taken in theſe ſkirmiſhes are ſold to the Mahometan merchants at Gondar; and at Conſtantinople, Cairo, or in India, the women are more eſteemed than thoſe of any other part of the world. Both ſexes have a cheerful, kind diſpoſition, and attach themſelves inviolably to their maſters, if properly treated. The people of Narea and Caffa ſpeak a language peculiar to themſelves.

NARRATION, in oratory, poetry, and hiſtory, a recital or rehearſal of a fact as it happened, or as it is ſuppoſed to have happened. See ORATORY, nº 26. 123.

Concerning NARRATION *and Deſcription*, we have the following rules and obſervations in the Elements of Criticiſm.

1. The firſt rule is, That in hiſtory the reflections ought to be chaſte and ſolid; for while the mind is intent upon truth, it is little diſpoſed to the operation of the imagination. Strada's Belgic hiſtory is full of poetical images, which, being diſcordant with the ſubject, are unpleaſant; and they have a ſtill worſe effect, by giving an air of fiction to a genuine hiſtory. Such flowers ought to be ſcattered with a ſparing hand, even in epic poetry; and at no rate are they proper till the reader be warmed, and by an enlivened imagination be prepared to reliſh them: in that ſtate of mind, they are agreeable; but while we are ſedate and attentive to an hiſtorical chain of facts, we reject with diſdain every fiction.

2. Vida, following Horace, recommends a modeſt commencement of an epic poem; giving for a reaſon, that the writer ought to huſband his fire. Beſides, bold thoughts and figures are never reliſhed till the mind be heated and thoroughly engaged, which is not the reader's caſe at the commencement. Homer introduces not a ſingle ſimile in the firſt book of the Iliad, nor in the firſt book of the Odyſſey. On the other hand, Shakeſpeare begins one of his plays with a ſentiment too bold for the moſt heated imagination:

Narration.

Bedford. Hung be the heav'ns with black, yield day to night!
Comets, importing change of times and ſtates,
Brandiſh your cryſtal treſſes in the ſky,
And with them ſcourge the bad revolting ſtars,
That have conſented unto Henry's death!
Henry the Fifth, too famous to live long!
England ne'er loſt a king of ſo much worth.

Firſt part Henry VI.

The paſſage with which Strada begins his hiſtory, is too poetical for a ſubject of that kind; and at any rate too high for the beginning of a grave performance.

3. A third rule or obſervation is, That where the ſubject is intended for entertainment ſolely, not for inſtruction, a thing ought to be deſcribed as it appears, not as it is in reality. In running, for example, the impulſe upon the ground is proportioned in ſome degree to the celerity of motion; though in appearance it is otherwiſe, for a perſon in ſwift motion ſeems to ſkim the ground, and ſcarcely to touch it. Virgil, with great taſte, deſcribes quick running according to appearance; and raiſes an image far more lively than by adhering ſcrupulouſly to truth:

Hos ſuper advenit Volſca de gente Camilla,
Agmen agens equitum et florentes ære catervas,
Bellatrix: non illa colo calathiſve Minervæ
Fœmineas aſſueta manus; ſed prælia virgo
Dura pati, curſuque pedum prævertere ventos.
Illa vel intactæ ſegetis per ſumma volaret
Gramina: nec teneras curſu læſiſſet ariſtas:
Vel mare per medium, fluctu ſuſpenſa tumenti,
Ferret iter: celeres nec tingeret æquore plantas.

Æneid. vii. 803.

4. In narration as well as in deſcription, objects ought to be painted ſo accurately as to form in the mind of the reader diſtinct and lively images. Every uſeleſs circumſtance ought indeed to be ſuppreſſed, becauſe every ſuch circumſtance loads the narration; but if a circumſtance be neceſſary, however ſlight, it cannot be deſcribed too minutely. The force of language conſiſts in raiſing complete images, which have the effect to tranſport the reader as by magic into the very place of the important action, and to convert him as it were into a ſpectator, beholding every thing that paſſes. The narrative in an epic poem ought to rival a picture in the livelineſs and accuracy of its repreſentations: no circumſtance muſt be omitted that tends to make a complete image; becauſe an imperfect image, as well as any other imperfect conception, is cold and unintereſting. We ſhall illuſtrate this rule by ſeveral examples, giving the firſt place to a beautiful paſſage from Virgil:

Qualis *populeâ* mœrens Philomela ſub umbrâ
Amiſſos queritur fœtus, quos durus *arator*
Obſervans nido *implumes* detraxit.

Georg. lib. 4. *l.* 511.

The poplar, plowman, and unfledged young, though not eſſential in the deſcription, tend to make a complete image, and upon that account are an embelliſhment.

Again:

Narration.

Again:

Hic viridem Æneas *frondenti ex ilice* metam
Conftituit, fignum nautis. *Æneid.* v. 129.

Horace addreffing to fortune:

Te pauper ambit follicita prece
Ruris colonus: te dominam æquoris,
Quicumque Bithynâ laceffit
Carpathium pelagus carinâ.
Carm. lib. 1. *ode* 35.

—— Illum ex mœnibus hofticis
Matrona bellantis tyranni
Profpiciens, et adulta virgo,
Sufpiret: Eheu, ne rudis agminum
Sponfus laceffat regius afperum
Tactu leonem, quem cruenta
Per medias rapit ira cædes.
Carm. lib. 3. *ode* 2.

Shakefpeare fays, "You may as well go about to turn the fun to ice by fanning in his face with a *peacock's* feather." The peacock's feather, not to mention the beauty of the object, completes the image: an accurate image cannot be formed of that fanciful operation, without conceiving a particular feather; and one is at a lofs when this is neglected in the defcription. Again, "The rogues flighted me into the river with as little remorfe, as they would have drown'd a bitch's blind puppies, fifteen i' th' litter."

Old Lady. You would not be a queen?
Anne. No, not for all the riches under heaven.
Old Lady. 'Tis ftrange: a three-pence bow'd would hire me, old as I am, to queen it.
Henry VIII. act. 2. *fc.* 5.

In the following paffage, the action, with all its material circumftances, is reprefented fo much to the life, that it would fcarce appear more diftinct to a real fpectator; and it is the manner of defcription that contributes greatly to the fublimity of the paffage.

He fpake; and, to confirm his words, out flew
Millions of flaming fwords, drawn from the thighs
Of mighty cherubim; the fudden blaze
Far round illumin'd hell: highly they rag'd
Againft the Higheft, and fierce with grafped arms,
Clafh'd on their founding fhields the din of war,
Hurling defiance toward the vault of heav'n.
Milton, b. 1.

The following paffage from Shakefpeare falls not much fhort of that now mentioned in particularity of defcription:

O you hard hearts! you cruel men of Rome!
Knew you not Pompey? Many a time and oft
Have you climb'd up to walls and battlements,
To tow'rs and windows, yea, to chimney-tops,
Your infants in your arms; and there have fat
The live-long day with patient expectation
To fee great Pompey pafs the ftreets of Rome;
And when you faw his chariot but appear,
Have you not made an univerfal fhout,
That Tyber trembled underneath his banks,
To hear the replication of your founds,
Made in his concave fhores?
Julius Cæfar, act 1. *fc.* 1.

The following paffage is fcarce inferior to either of thofe mentioned:

"Far before the reft, the fon of Offian comes: bright in the fmiles of youth, fair as the firft beams of the fun. His long hair waves on his back: his dark brow is half beneath his helmet. The fword hangs loofe on the hero's fide; and his fpear glitters as he moves. I fled from his terrible eye, King of high Temora." *Fingal.*

The Henriade of Voltaire errs greatly againft the foregoing rule: every incident is touched in a fummary way, without ever defcending to circumftances. This manner is good in a general hiftory, the purpofe of which is to record important tranfactions: but in a fable it is cold and uninterefting; becaufe it is impracticable to form diftinct images of perfons or things reprefented in a manner fo fuperficial.

It is obferved above, that every ufelefs circumftance ought to be fuppreffed. The crowding fuch circumftances is, on the one hand, not lefs to be avoided, than the concifenefs for which Voltaire is blamed, on the other. In the Æneid, Barce, the nurfe of Sichæus, whom we never hear of before nor after, is introduced for a purpofe not more important than to call Anna to her fifter Dido: and that it might not be thought unjuft in Dido, even in this trivial circumftance, to prefer her hufband's nurfe before her own, the poet takes care to inform his reader, that Dido's nurfe was dead. To this may be oppofed a beautiful paffage in the fame book, where, after Dido's laft fpeech, the poet, without detaining his readers by defcribing the manner of her death, haftens to the lamentation of her attendants:

Dixerat: atque illam media inter talia ferro
Collapfam afpiciunt comites, enfemque cruore
Spumantem, fparfafque manus. It clamor ad alta
Atria, concuffam bacchatur fama per urbem;
Lamentis gemituque et fœmineo ululatu
Tecta fremunt, refonat magnis plangoribus æther.
Lib. 4. l. 663.

As an appendix to the foregoing rule, may be added the following obfervation, That to make a fudden and ftrong impreffion, fome fingle circumftance, happily felected, has more power than the moft laboured defcription. Macbeth, mentioning to his lady fome voices he heard while he was murdering the King, fays,

There's one did laugh in fleep, and one cry'd Murder!
They wak'd each other; and I ftood and heard them;
But they did fay their prayers, and addrefs them
Again to fleep.
Lady. There are two lodg'd together.
Macbeth. One cry'd, God blefs us! and, Amen! the other;
As they had feen me with thefe hangman's hands.
Liftening their fear, I could not fay, Amen,
When they did fay, God blefs us.
Lady. Confider it not fo deeply.
Macbeth. But wherefore could not I pronounce Amen?
I had moft need of bleffing, and Amen
Stuck in my throat.

Lady,

Narration.

Lady. Thefe deeds muft not be thought
After thefe ways; fo, it will make us mad.
Macbeth. Methought, I heard a voice cry,
Sleep no more!
Macbeth doth murder fleep, &c. *Act 2. fc.* 3.

Defcribing prince Henry:

I faw young Harry, with his beaver on,
His cuiffes on his thighs, gallantly arm'd,
Rife from the ground like feather'd Mercury;
And vaulted with fuch eafe into his feat,
As if an angel dropt down from the clouds,
To turn and wind a fiery Pegafus,
And witch the world with noble horfemanfhip.
First part Henry IV. act 4. *fc.* 2.

King Henry. Lord Cardinal, if thou think'ft on
Heaven's blifs,
Hold up thy hand, make fignal of thy hope.
He dies, and makes no fign!
Second part Henry VI. act. 3. *fc.* 10.

The fame author, fpeaking ludicroufly of an army debilitated with difeafes, fays,

"Half of them dare not fhake the fnow from off their caffocks, left they fhake themfelves to pieces."

"I have feen the walls of Balclutha, but they were defolate. The flames had refounded in the halls: and the voice of the people is heard no more. The ftream of Clutha was removed from its place by the fall of the walls. The thiftle fhook there its lonely head: the mofs whiftled to the wind. The fox looked out from the windows; and the rank grafs of the wall waved round his head. Defolate is the dwelling of Morna: filence is in the houfe of her fathers." *Fingal.*

To draw a character is the mafter ftroke of defcription. In this Tacitus excels: his portraits are natural and lively, not a feature wanting or mifplaced. Shakefpeare, however, exceeds Tacitus in livelinefs; fome characteriftical circumftance being generally invented or laid hold of, which paints more to the life than many words. The following inftances will explain our meaning, and at the fame time prove our obfervation to be juft.

Why fhould a man, whofe blood is warm within,
Sit like his grandfire cut in alabafter?
Sleep when he wakes, and creep into the jaundice,
By being peevifh? I tell thee what, Anthonio,
(I love thee, and it is my love that fpeaks),
There are a fort of men, whofe vifages
Do cream and mantle like a ftanding pond;
And do a wilful ftillnefs entertain,
With purpofe to be drefs'd in an opinion
Of wifdom, gravity, profound conceit;
As who fhould fay, I am Sir Oracle,
And when I ope my lips, let no dog bark!
O my Anthonio! I do know of thofe,
That therefore only are reputed wife,
For faying nothing.
Merchant of Venice, act. 1. *fc.* 2.

Again:

"Gratiano fpeaks an infinite deal of nothing, more than any man in all Venice: his reafons are two grains of wheat hid in two bufhels of chaff; you fhall feek all day ere you find them; and when you have them, they are not worth the fearch." *Ibid.*

In the following paffage, a character is completed by a fingle ftroke:

Shallow. O the mad days that I have fpent; and to fee how many of mine old acquaintance are dead.
Silence. We fhall all follow, coufin.
Shallow. Certain, 'tis certain, very fure, very fure; Death (as the Pfalmift faith) is certain to all: all fhall die. How good a yoke of bullocks at Stamford fair?
Slender. Truly, coufin, I was not there.
Shallow. Death is certain. Is old *Double* of your town living yet?
Silence. Dead, Sir.
Shallow. Dead! fee, fee; he drew a good bow: and dead. He fhot a fine fhoot. How a fcore of ewes now?
Silence. Thereafter as they be. A fcore of good ewes may be worth ten pounds.
Shallow. And is old *Double* dead?
Second Part Henry IV. *act.* 3. *fc.* 3.

Defcribing a jealous hufband:

"Neither prefs, coffer, cheft, trunk, well, vault, but he hath an abftract for the remembrance of fuch places, and goes to them by his note. There is no hiding you in the houfe." *Merry Wives of Windfor, act.* 4. *fc.* 3.

Congreve has an inimitable ftroke of this kind in his comedy of *Love for Love:*

Ben Legend. Well, father, and how do all at home? how does brother Dick, and brother Val?
Sir Sampfon. Dick, body o' me, Dick has been dead thefe two years. I writ you word when you were at Leghorn.
Ben. Mefs, that's true; marry, I had forgot. Dick's dead, as you fay. *Act* 3. *fc.* 6.

Falftaff fpeaking of Ancient Piftol:

"He's no fwaggerer, hoftefs; a tame cheater i'faith; you may ftroak him as gently as a puppy-greyhound; he will not fwagger with a Barbary hen, if her feathers turn back in any fhow of refiftance."
Second part Henry IV. *act* 2. *fc.* 9.

Offian among his other excellencies is eminently fuccefsful in drawing characters; and he never fails to delight his reader with the beautiful attitudes of his heroes. Take the following inftances:

"O Ofcar! bend the ftrong in arm; but fpare the feeble hand. Be thou a ftream of many tides againft the foes of thy people; but like the gale that moves the grafs to thofe who afk thine aid.—So Trenmor lived; fuch Trathal was; and fuch has Fingal been. My arm was the fupport of the injured; and the weak refted behind the lightning of my fteel."

"We heard the voice of joy on the coaft, and we thought that the mighty Cathmor came. Cathmor the friend of ftrangers! the brother of red-haired Cairbar! But their fouls were not the fame; for the light of heaven was in the bofom of Cathmor. His towers rofe on the banks of Atha: feven paths led to his halls: feven chiefs ftood on thefe paths, and called the ftranger to the feaft. But Cathmor dwelt in the wood to avoid the voice of praife."

"Dermid and Ofcar were one: they reaped the battle together. Their friendfhip was ftrong as their fteel;

steel; and death walked between them to the field. They rush on the foe like two rocks falling from the brow of Ardven. Their swords are stained with the blood of the valiant: warriors faint at their name. Who is equal to Oscar but Dermid? who to Dermid but Oscar?"

"Son of Comhal, replied the chief, the strength of Morni's arm has failed: I attempted to draw the sword of my youth, but it remains in its place: I throw the spear, but it falls short of the mark: and I feel the weight of my shield. We decay like the grass of the mountain, and our strength returns no more. I have a son, O Fingal! his soul has delighted in the actions of Morni's youth; but his sword has not been fitted against the foe, neither has his fame begun. I come with him to battle, to direct his arm. His renown will be a sun to my soul, in the dark hour of my departure. O that the name of *Morni* were forgot among the people! that the heroes would only say, *Behold the father of Gaul.*"

Some writers, through heat of imagination, fall into contradiction; some are guilty of downright absurdities; and some even rave like madmen. Against such capital errors one cannot be more effectually warned than by collecting instances; and the first shall be of a contradiction, the most venial of all. Virgil speaking of Neptune,

> Interea magno misceri murmure pontum,
> Emissamque hyemem sensit Neptunus, et imis
> Stagna refusa vadis: *graviter commotus*, et alto
> Prospiciens, summâ *placidum* caput extulit undâ.
>
> *Æneid.* i. 128.

Again:

> When first young Maro, in his boundless mind,
> A work t'outlast *immortal* Rome design'd.
>
> *Essay on Criticism, l.* 30.

The following examples are of absurdities.

"Alii pulsis e tormento catenis discerpti sectique, dimidiato corpore pugnabant sibi superstites, ac peremptæ partis ultores." *Strada, dec.* 2. *l.* 2.

> Il povér huomo, che non sen' era accorto,
> Andava combattendo, ed era morto. *Berni.*

> He fled, but flying, left his life behind.
>
> *Iliad*, xi. 443.

> Full through his neck the weighty falchion sped:
> Along the pavement roll'd the mutt'ring head.
>
> *Odyssey*, xxii. 365.

The last article is of raving like one mad. Cleopatra speaking to the aspic,

> ——————Welcome, thou kind deceiver,
> Thou best of thieves; who, with an easy key,
> Dost open life, and unperceiv'd by us
> Ev'n steal us from ourselves; discharging so
> Death's dreadful office, better than himself;
> Touching our limbs so gently into slumber,
> That Death stands by, deceiv'd by his own image,
> And thinks himself but sleep.
>
> *Dryden, All for Love, act* 5.

Having discussed what observations occurred upon the thoughts or things expressed, we proceed to what more peculiarly concerns the language or verbal dress. As words are intimately connected with the ideas they represent, the emotions raised by the sound and by the sense ought to be concordant. An elevated subject requires an elevated style; what is familiar, ought to be familiarly expressed: a subject that is serious and important, ought to be clothed in plain nervous language: a description, on the other hand, addressed to the imagination, is susceptible of the highest ornaments that sounding words and figurative expression can bestow upon it.

We shall give a few examples of the foregoing rules. A poet of any genius is not apt to dress a high subject in low words; and yet blemishes of that kind are found even in classical works. Horace, observing that men are satisfied with themselves, but seldom with their condition, introduces Jupiter indulging to each his own choice:

> Jam faciam quod vultis; eris tu, qui modo miles,
> Mercator: tu, consultus modo, rusticus: hinc vos,
> Vos hinc mutatis discedite partibus: eia,
> Quid statis? nolint: atqui licet esse beatis.
> Quid causæ est, merito quin illis *Jupiter ambas*
> *Iratus buccas inflet?* neque se fore posthac
> Tam facilem dicat, votis ut præbeat aurem?
>
> *Sat. lib.* 1. *sat.* 1. *l.* 16.

Jupiter in wrath puffing up both cheeks, is a low and even ludicrous expression, far from suitable to the gravity and importance of the subject: every one must feel the discordance. The following couplet, sinking far below the subject, is no less ludicrous:

> Not one looks backward, onward still he goes,
> Yet ne'er looks forward farther than his nose.
>
> *Essay on Man, ep.* iv. 223.

On the other hand, to raise the expression above the tone of the subject, is a fault than which none is more common. Take the following instances:

> Orcan le plus fidéle à server ses desseins,
> Ne sous le ciel brûlant des plus noirs Affricains.
>
> *Bajacet, act* 3. *sc.* 8.

> Les ombres par trois fois ont obscurci les cieux,
> Depuis que le sommeil n'est entré dans vos yeux;
> Et le jour a trois fois chassé la nuit obscure
> Depuis que votre corps languit sans nourriture.
>
> *Phedra, act* 1. *sc.* 3.

Assueris. Ce mortel, qui montra tant de zéle pour moi, Vit-il encore?

Asaph. ———Il voit l'astre qui vous éclaire.

Esther, act 2. *sc.* 3.

> Oui, c'est Agamemnon, c'est ton roi qui t'eveille;
> Viens, reconnois la voix qui frappe ton oreille.
>
> *Iphigenie.*

> No jocund health that Denmark drinks to-day,
> But the great cannon to the clouds shall tell;
> And the king's rowse the heav'n shall bruit again,
> Respeaking earthly thunder.
>
> *Hamlet, act* 1. *sc.* 2.

> ————————In the inner room
> I spy a winking lamp, that weakly strikes
> The ambient air, scarce kindling into light.
>
> *Southerne, Fate of Capua, act* 3.

In the funeral orations of the bishop of Meaux, the following passages are raised far above the tone of the subject:

"L'Ocean etonné de se voir traversé tant de fois, en des

Narration.

des appareils si divers, et pour des causes si differentes, &c." *p.* 6.

"Grande reine, je satisfais à vos plus tendres desirs, quand je célébre ce monarque; et son cœur qui n'a jamais vêcu qui pour lui, se eveille, tout poudre qu'il est, et devient sensible, même sous ce drap mortuaire, au nom d'un epoux si cher" *p.* 32.

The following passage, intended, one would imagine, as a receipt to boil water, is altogether burlesque by the laboured elevation of the diction:

A massy cauldron of stupendous frame
They brought, and plac'd it o'er the rising flame:
Then heap the lighted wood; the flame divides
Beneath the vase, and climbs around the sides:
In its wide womb they pour the rushing stream:
The boiling water bubbles to the brim.
Iliad. xviii. 405.

In a passage at the beginning of the 4th book of Telemachus, one feels a sudden bound upward without preparation, which accords not with the subject:

"Calypso, qui avoit été jusqu' à ce moment immobile et transportée de plaisir en écoutant les avantures de Télémaque, l'interrompit pour lui faire prendre quelque repôs. Il est tems, lui dit-elle, que vous alliez goûter la douceur du sommeil apprés tant de travaux. Vous n'avez rien à craindre ici; tout vous est favorable. Abandonnez vous donc à la joye. Goutez la paix, et tous les autres dons des dieux dont vous allez être comblé. Demain, *quand l'Aurore avec ses doigts de rôses entr'ouvira les portes dorées de l'Orient, et que le chevaux du soleil sortans de l'onde amére répandront les flames du jour, pour chasser devant eux toutes les etoiles du ciel*, nous reprendrons, mon cher Télémaque, l'histoire de vos malheurs."

This obviously is copied from a similar passage in the Æneid, which ought not to have been copied, because it lies open to the same censure; but the force of authority is great:

At regina gravi jamdudum saucia cura
Vulnus alit venis, et cæco carpitur igni.
Multa viri virtus animo, multusque recursat
Gentis honos: hærent infixi pectore vultus,
Verbaque: nec placidam membris dat cura quietem.
Postera Phœbea lustrabat lampade terras,
Humentemque Aurora polo dimoverat umbram;
Cum sic unanimem alloquitur malesana sororem.
Lib. iv. 1.

The language of Homer is suited to his subject, not less accurately than the actions and sentiments of his heroes are to their characters. Virgil, in that particular, falls short of perfection: his language is stately throughout: and though he descends at times to the simplest branches of cookery, roasting and boiling for example, yet he never relaxes a moment from the high tone.—In adjusting his language to his subject, no writer equals Swift. We can recollect but one exception, which at the same time is far from being gross: The Journal of a modern Lady is composed in a style blending sprightliness with familiarity, perfectly suited to the subject: in one passage, however, the poet, deviating from that style, takes a tone above his subject. The passage we have in view begins *l.* 116. But *let me now a while survey, &c.* and ends at *l.* 135.

It is proper to be observed upon this head, that writers of inferior rank are continually upon the stretch to enliven and enforce their subject by exaggeration and superlatives. This unluckily has an effect contrary to what is intended: the reader, disgusted with language that swells above the subject, is led by contrast to think more meanly of the subject than it may possibly deserve. A man of prudence, beside, will be no less careful to husband his strength in writing than in walking: a writer, too liberal of superlatives, exhausts his whole stock upon ordinary incidents, and reserves no share to express, with greater energy, matters of importance.

Many writers of that kind abound so in epithets, as if poetry consisted entirely in high-sounding words. Take the following instance:

When black-brow'd night her dusky mantle spread,
And wrapt in solemn gloom the sable sky;
When soothing sleep her opiate dews had shed,
And seal'd in silken slumbers every eye:
My waking thought admits no balmy rest,
Nor the sweet bliss of soft oblivion share:
But watchful wo distracts my aching breast,
My heart the subject of corroding care:
From haunts of men with wandring steps and slow
I solitary steal, and soothe my pensive wo.

Here every substantive is faithfully attended by some tumid epithet.

We proceed to a second remark, not less important than the former. No person of reflection but must be sensible, that an incident makes a stronger impression on an eye-witness, than when heard at second-hand Writers of genius, sensible that the eye is the best avenue to the heart, represent every thing as passing in our sight; and, from readers or hearers, transform us as it were into spectators: a skilful writer conceals himself, and presents his personages: in a word, every thing becomes dramatic as much as possible. Plutarch, *de gloria Atheniensium*, observes, that Thucydides makes his reader a spectator, and inspires him with the same passions as if he were an eye-witness.

In the fine arts, it is a rule to put the capital objects in the strongest point of view; and even to present them oftener than once, where it can be done. In history-painting, the principal figure is placed in the front, and in the best light: an equestrian statue is placed in a centre of streets, that it may be seen from many places at once. In no composition is there greater opportunity for this rule than in writing:

——Sequitur pulcherrimus Astur,
Astur equo fidens et versicoloribus armis.
Æneid. x. 180.

——Full many a lady
I've ey'd with best regard, and many a time
Th' harmony of their tongues hath into bondage
Brought my too diligent ear: for several virtues
Have I lik'd several women; never any
With so full soul, but some defect in her
Did quarrel with the noblest grace she ow'd,
And put it to the foil. But you, O you,
So perfect, and so peerless, are created
Of every creature's best. *Tempest, act* 3. *sc.* 1.

Orlando.

Narration.

Orlando.——— Whate'er you are
That, in the defart inacceffible,
Under the fhade of melancholy boughs,
Lofe and neglect the creeping hours of time;
If ever you have look'd on better days;
If ever been where bells have knoll'd to church;
If ever fat at any good man's feaft;
If ever from your eye-lids wip'd a tear,
And know what 'tis to pity, and be pity'd;
Let gentlenefs my ftrong inforcement be,
In the which hope I blufh, and hide my fword.
Duke fen. True is it that we have feen better days;
And have with holy bell been knoll'd to church;
And fat at good mens feafts; and wip'd our eyes
Of drops that facred pity had engender'd:
And therefore fit you down in gentlenefs,
And take upon command what help we have,
That to your wanting may be miniftred.
As you like it.

With the converfing I forgot all time;
All feafons and their change, all pleafe alike.
Sweet is the breath of morn, her rifing fweet,
With charm of earlieft birds; pleafant the fun
When firft on this delightful land he fpreads
His orient beams on herbs, tree, fruit, and flow'r
Gliftring with dew; fragrant the fertile earth
After foft fhow'rs; and fweet the coming on
Of grateful ev'ning mild, the filent night
With this her folemn bird, and this fair moon,
And thefe the gems of heav'n, her ftarry train:
But neither breath of morn, when fhe afcends
With charm of earlieft birds, nor rifing fun
On this delightful land, nor herb, fruit, flow'r,
Glift'ring with dew, nor fragrance after fhow'rs,
Nor grateful ev'ning mild, nor filent night,
With this her folemn bird, nor walk by moon,
Or glittering ftar-light, without thee is fweet.
Paradife Loft, book 4. *l.* 634.

"What mean ye, that ye ufe this proverb, The fathers have eaten four grapes, and the childrens teeth are fet on edge? As I live, faith the Lord God, ye fhall not have occafion to ufe this proverb in Ifrael. If a man keep my judgments to deal truly, he is juft, he fhall furely live. But if he be a robber, a fhedder of blood; if he have eaten upon the mountains, and defiled his neighbour's wife; if he have oppreffed the poor and needy, have fpoiled by violence, have not reftored the pledge, have lift up his eyes to idols, have given forth upon ufury, and have taken increafe: fhall he live? he fhall not live: he fhall furely die; and his blood fhall be upon him. Now, lo, if he beget a fon, that feeth all his father's fins, and confidereth, and doeth not fuch like; that hath not eaten upon the mountains, hath not lift up his eyes to idols, nor defiled his neighbour's wife, hath not oppreffed any, nor withheld the pledge, neither hath fpoiled by violence, but hath given his bread to the hungry, and covered the naked with a garment; that hath not received ufury nor increafe, that hath executed my judgments, and walked in my ftatutes: he fhall not die for the iniquity of his father; he fhall furely live. The foul that finneth, it fhall die; the fon fhall not bear the iniquity of the father, neither fhall the father bear the iniquity of the fon; the righteoufnefs of the righteous fhall be upon him, and the wickednefs of the wicked fhall be upon him. Have I any pleafure that the wicked fhould die, faith the Lord God; and not that he fhould return from his ways, and live?" *Ezekiel* xvii.

Narration.

A concife comprehenfive ftyle is a great ornament in narration; and a fuperfluity of unneceffary words, not lefs than of circumftances, a great nuifance. A judicious felection of the ftriking circumftances, clothed in a nervous ftyle, is delightful. In this ftyle, Tacitus excels all writers, ancient and modern. Inftances are numberlefs: take the following fpecimen:

"Crebra hinc prælia, et fæpius in modum latrocinii: per faltus, per paludes; ut cuique fors aut virtus: temere, provifo, ob iram, ob prædam, juffu, et aliquando ignaris ducibus." *Annal. lib.* 12. § 39.

After Tacitus, Offian in that refpect juftly merits the place of diftinction. One cannot go wrong for examples in any part of the book.

If a concife or nervous ftyle be a beauty, tautology muft be a blemifh; and yet writers, fettered by verfe, are not fufficiently careful to avoid this flovenly practice: they may be pitied, but they cannot be juftified. Take for a fpecimen the following inftances, from the beft poet, for verfification at leaft, that England has to boaft of:

High on his helm celeftial lightnings play,
His beamy fhield emits a living ray;
Th' unweary'd blaze inceffant ftreams fupplies,
Like the red ftar that fires the autumnal fkies.
Iliad v. 5.

Strength and omnipotence inveft thy throne.
Ibid. viii. 576.

So filent fountains, from a rock's tall head,
In fable ftreams foft trickling waters fhed.
Ibid. ix. 19.

His clanging armour rung. *Ibid.* xii. 94.

Fear on their cheek, and horror in their eye.
Ibid. xv. 4.

The blaze of armour flafh'd againft the day.
Ibid. xvii. 736.

As when the piercing blafts of Boreas blow.
Ibid. xix. 380.

And like the moon, the broad refulgent fhield
Blaz'd with long rays, and gleam'd athwart the field.
Ibid. xix. 402.

No—could our fwiftnefs o'er the winds prevail,
Or beat the pinions of the weftern gale,
All were in vain—— *Ibid.* xix. 604.

The humid fweat from ev'ry pore defcends.
Ibid. xxiii. 829.

We clofe this article with a curious inquiry. An object, however ugly to the fight, is far from being fo when reprefented by colours or by words. What is the caufe of this difference? With refpect to painting, the caufe is obvious: a good picture, whatever the fubject be, is agreeable by the pleafure we take in imitation; and this pleafure overbalancing the difagreeablenefs of the fubject, makes the picture upon the whole agreeable. With refpect to the defcription of an ugly object, the caufe follows. To connect individuals in the focial ftate, no particular contributes more than language, by the power it poffeffes of an expeditious communication of thought, and a lively reprefentation of tranfactions. But nature hath not

been ſatisfied to recommend language by its utility merely: independent of utility, it is made ſuſceptible of many beauties, which are directly felt, without any intervening reflection. And this unfolds the myſtery; for the pleaſure of language is ſo great, as in a lively deſcription to overbalance the diſagreeableneſs of the image raiſed by it. This, however, is no encouragement to chooſe a diſagreeable ſubject; for the pleaſure is incomparably greater where the ſubject and the deſcription are both of them agreeable.

The following deſcription is upon the whole agreeable, though the ſubject deſcribed is in itſelf diſmal:

Nine times the ſpace that meaſures day and night
To mortal men, he with his horrid crew
Lay vanquiſh'd, rolling in the fiery gulf,
Confounded though immortal! but his doom
Reſerv'd him to more wrath; for now the thought
Both of loſt happineſs and laſting pain
Torments him; round he throws his baleful eyes
That witneſs'd huge affliction and diſmay:
Mix'd with obdurate pride and ſtedfaſt hate:
At once as far as angels ken he views
The diſmal ſituation waſte and wild:
A dungeon horrible, on all ſides round
As one great furnace flamed; yet from thoſe flames
No light, but rather darkneſs viſible
Serv'd only to diſcover ſights of wo,
Regions of ſorrow, doleful ſhades, where peace
And reſt can never dwell, hope never comes
That comes to all; but torture without end
Still urges, and a fiery deluge, fed
With ever-burning ſulphur unconſum'd!
Such place eternal juſtice had prepar'd
For thoſe rebellious. *Paradiſe Loſt, book* 1. *l.* 50.

An unmanly depreſſion of ſpirits in time of danger is not an agreeable ſight; and yet a fine deſcription or repreſentation of it will be reliſhed:

K. Richard. What muſt the king do now? muſt he ſubmit?
The king ſhall do it: muſt he be depos'd?
The king ſhall be contented: muſt he loſe
The name of king? o' God's name let it go;
I'll give my jewels for a ſet of beads;
My gorgeous palace, for a hermitage;
My gay apparel, for an almſman's gown;
My figur'd goblets, for a diſh of wood;
My ſceptre, for a palmer's walking-ſtaff;
My ſubjects, for a pair of carved ſaints;
And my large kingdom, for a little grave;
A little, little grave,—an obſcure grave.
Or I'll be bury'd in the king's highway;
Some way of common tread, where ſubjects feet
May hourly trample on their ſovereign's head;
For on my heart they tread now, whilſt I live;
And, bury'd once, why not upon my head?
Richard II. act 3. *ſc.* 6.

Objects that ſtrike terror in a ſpectator, have in poetry and painting a fine effect. The picture, by raiſing a ſlight emotion of terror, agitates the mind; and in that condition every beauty makes a deep impreſſion. May not contraſt heighten the pleaſure, by oppoſing our preſent ſecurity to the danger of encountering the object repreſented?

———————The other ſhape,
If ſhape it might be call'd that ſhape had none
Diſtinguiſhable in member, joint, or limb;
Or ſubſtance might be call'd that ſhadow ſeem'd,
For each ſeem'd either; black it ſtood as night,
Fierce as ten furies, terrible as hell,
And ſhook a dreadful dart. *Par. Loſt, b.* 2. *l.* 666.

———————Now ſtorming fury roſe,
And clamour ſuch as heard in heaven till now
Was never: arms on clamour claſhing bray'd
Horrible diſcord, and the madding wheels
Of brazen chariots rage; dire was the noiſe
Of conflict; overhead the diſmal hiſs
Of fiery darts in flaming vollies flew,
And flying vaulted either hoſt with fire.
So under fiery cope together ruſh'd
Both battles main, with ruinous aſſault
And inextinguiſhable rage: all heaven
Reſounded, and had earth been then, all earth
Had to her centre ſhook. *Ibid. book* 6. *l.* 207.

Ghoſt. ——————But that I am forbid
To tell the ſecrets of my priſon-houſe,
I could a tale unfold, whoſe lighteſt word
Would harrow up thy ſoul, freeze thy young blood,
Make thy two eyes, like ſtars, ſtart from their ſpheres,
Thy knotty and combined locks to part,
And each particular hair to ſtand on end,
Like quills upon the fretful porcupine:
But this eternal blazon muſt not be
To ears of fleſh and blood. *Hamlet, act* 1. *ſc.* 8.

Gratiano. Poor Deſdemona! I'm glad thy father's dead:
Thy match was mortal to him; and pure grief
Shore his old thread in twain. Did he live now,
This ſight would make him do a deſp'rate turn:
Yea, curſe his better angel from his ſide,
And fall to reprobation. *Othello, act* 5. *ſc.* 8.

Objects of horror muſt be excepted from the foregoing theory; for no deſcription, however lively, is ſufficient to overbalance the diſguſt raiſed even by the idea of ſuch objects. Every thing horrible ought therefore to be avoided in a deſcription.

NARSES, the eunuch who rivalled Beliſarius in heroiſm under the reign of the emperor Juſtinian, emerged from obſcurity A. D. 538. From the domeſtic ſervice of the palace, and the adminiſtration of the private revenue, he was ſuddenly exalted to the head of an army. He is ranked among the few eunuchs who have reſcued that unhappy name from the contempt and hatred of mankind. A feeble diminutive body concealed the ſoul of a ſtateſman and a warrior. His youth had been employed in the management of the loom and diſtaff, in the cares of the houſehold, and the ſervice of female luxury; but, while his hands were buſy, he ſecretly exerciſed the faculties of a vigorous and diſcerning mind. A ſtranger to the ſchools and the camp, he ſtudied in the palace to diſſemble, to flatter, and to perſuade; and as ſoon as he approached the perſon of the emperor, Juſtinian liſtened with ſurpriſe and pleaſure to the manly counſels of his chamberlain and private treaſurer. The talents of Narſes were tried and improved in frequent embaſſies; he led an army into Italy, acquired a practical

tical knowledge of the war and the country, and prefumed to ftrive with the genius of Belifarius. Twelve years after his return, the eunuch was chofen to atchieve the conqueft which had been left imperfect by the firft of the Roman generals. Inftead of being dazzled by vanity or emulation, he ferioufly declared, that unlefs he were armed with an adequate force, he would never confent to rifk his own glory and that of his fovereign. Juftinian granted to the favourite what he might have denied to the hero: the Gothic war was rekindled from its afhes, and the preparations were not unworthy of the ancient majefty of the empire.

Narfes defeated the Goths, the Franks, and the Alemanni; the Italian cities opened their gates to the conqueror; he entered the capital in triumph; and having eftablifhed the feat of his government at Ravenna, continued 15 years to govern Italy under the title of *Exarch*.

His virtues, we are told, were ftained with avarice; and in this provincial reign he accumulated a treafure of gold and filver which furpaffed the modefty of a private fortune. His government was oppreffive or unpopular; and the general difcontent was expreffed with freedom by the deputies of Rome. Before the throne of Juftinian they boldly declared, that their Gothic fervitude had been more tolerable than the defpotifm of a Greek eunuch; and that unlefs their tyrant were inftantly removed, they would confult their own happinefs in the choice of a mafter. Thus was his difgrace the effect of the people's difaffection; and his death, though in the extreme period of old age, was unfeafonable and premature, fince his genius alone could have repaired the laft and fatal error of his life. He died about the year 567, and, as fome fay, at the advanced age of 95; but this does not appear very probable. See Gibbon's Rom. Hift. vol. iv. 4to edit. p. 194, 29-, &c.

NARVA, a ftrong town of the Ruffian empire, in Livonia, with a caftle and a harbour. It was taken by the Mufcovites from the Danes in 1558, by the Swedes in 1581, and they defeated the Mufcovites near it in 1700; but it was retaken by the Ruffians in 1704 by ftorm, and the inhabitants fent to Aftracan. It is feated on the river Narva, 95 miles S. W. of Wiburg, and 172 N. E. of Riga. E. Long. 29. 0. N. Lat. 59. 8.

NARWAL, in ichthyology. See Monodon.

NASSAU-siegen, a fmall principality of Germany in the Wefterwalde, is in general a mountainous woody country, with fome arable and pafture ground, and a good breed of cattle. Its manufactures are chiefly thofe of iron and fteel, having an iron mine in the neighbourhood of Siegen. Count John the Younger, in 1626, embraced the Roman Catholic religion, and endeavoured to introduce it into the country; but the principality, upon the extinction of the line of Naffau-Siegen in 1743, falling to the line of Naffau-Dietz, and therein to the prince of Orange, hereditary ftadtholder of the United Provinces, the Proteftants were delivered from their apprehenfions of Popifh tyranny and bigotry. The prince, on account of thefe territories, has a feat and voice at the diets of the empire and circle in the college of princes. His affeffment in the matricula for Naffau Siegen is 773 florins monthly; and towards the maintenance of the chamber-judicatory, 50 rix-dollars fix kruitzers and a half each term. The revenue of this principality is eftimated at 100,000 rix-dollars.

Nassau-Dillenbourg, a principality of Germany, fituated near the former. It has not much arable land, but plenty of wood, good quarries of ftone, fome filver and vitriol, copper and lead, with ftore of iron, for the working and fmelting of which there are many forges and founderies in the country; and by thefe, and the fale of their iron, the inhabitants chiefly fubfift. Calvinifm is the religion of the principality, which contains five towns and two boroughs, and belongs entirely to William V. prince of Orange, and hereditary ftadtholder of the United Provinces, whofe father fucceeded to a part of it in 1739 on the death of prince Chriftian, and to the reft in 1743 on the death of prince William Hyacynth of Siegen. The prince, on account of this principality alfo and Dietz, has a feat and voice in the college of princes, at the diets of the empire and circle. His affeffment in the matricula, for Naffau-Dillenbourg, is 102 florins monthly; and to the chamber-judicatory, 50 rix-dollars fix and a half kruitzers, each term. His revenue from this principality is computed at above 130,000 florins.

Nassau-Hadamar, a county of Germany, which, till the year 1711, had princes of its own; but now belongs wholly to William V. prince of Orange.

Nassau, prince of Orange. See Maurice.

NATES, in anatomy, a term expreffing thofe two flefhy exterior parts of the body vulgarly called the *buttocks*. See Anatomy.

Nates Cerebri, are two circular protuberances of the brain, fituated on the back-fide of the medulla oblongata, near the cerebellum.

NATION, a collective term, ufed for a confiderable number of people inhabiting a certain extent of land, confined within fixed limits, and under the fame government.

NATIONAL debt: the money owing by government.

Our limits permit us to give but a very general fketch of this fubject: However, as it is of confiderable importance to every inhabitant of thefe kingdoms, we fhall endeavour to give as clear and comprehenfive a view of it as the bounds neceffarily prefcribed us will admit. In order to this, it may not be improper to refer back to the times that have gone before us, that we may the better difcover the nature of public revenues, the manner of their expenditure, and the caufes of public debt.

In that rude ftate of fociety which precedes the extenfion of commerce and the improvements of manufactures, when thofe expenfive luxuries which commerce and manufactures can alone introduce, are altogether unknown; the perfon who poffeffes a large revenue can fpend or enjoy that revenue in no other way than by maintaining nearly as many people as it can maintain. Among our feudal anceftors, the long time during which eftates ufed to continue in the fame family, fufficiently demonftrates the general difpofition of people to live within their income. Though the ruftic hofpitality conftantly exercifed by the great landholders may not to us in the prefent times feem

Smith's Wealth of Nations.

National.

consistent with that order which we are apt to consider as inseparably connected with good œconomy, yet we must certainly allow them to have been at least so far frugal as not commonly to have spent their whole income. Some part of this money, perhaps, they spent in purchasing the few objects of vanity and luxury with which the circumstances of the times could furnish them; but some part of it they seem commonly to have hoarded. They could not well indeed do any thing else but hoard whatever money they saved. To trade was disgraceful to a gentleman; and to lend money at interest, which at that time was considered as usury and prohibited by law, would have been still more so.

The same disposition to save and to hoard prevailed in the sovereign as well as in the subjects. Among nations to whom commerce and manufactures are little known, the sovereign is in a situation which naturally disposes him to the parsimony requisite for accumulation. In that situation the expence even of a sovereign cannot be directed by that vanity which delights in the gaudy finery of a court. The ignorance of the times affords but few of the trinkets in which that finery consists. Standing armies are not then necessary; so that the expence even of a sovereign, like that of any other great lord, can be employed in scarce any thing but bounty to his tenants and hospitality to his retainers. But bounty and hospitality very seldom lead to extravagance: though vanity almost always does. All the ancient sovereigns of Europe accordingly had treasures. Every Tartar chief in the present times is said to have one.

In a commercial country abounding with every sort of expensive luxury, the sovereign, in the same manner as almost all the great proprietors in his dominions, naturally spends a great part of his revenue in purchasing those luxuries. His own and the neighbouring countries supply him abundantly with all the costly trinkets which compose the splendid but insignificant pageantry of a court. His ordinary expence becomes equal to his ordinary revenue, and it is well if it does not frequently exceed it. The amassing of treasure can no longer be expected; and when extraordinary exigencies require extraordinary expences, he must necessarily call upon his subjects for an extraordinary aid. The late king of Prussia and his father are the only great princes of Europe who, since the death of Henry IV. of France in 1610, are supposed to have amassed any considerable treasure. The parsimony which leads to accumulation has become almost as rare in republican as in monarchical governments. The Italian republics, the United Provinces of the Netherlands, are all in debt. The canton of Berne is the single republic in Europe which has amassed any considerable treasure. The other Swiss republics have not. The taste for some sort of pageantry, for splendid buildings at least and other public ornaments, frequently prevails as much in the apparently sober senate-house of a little republic as in the dissipated court of the greatest king.

The want of parsimony in time of peace imposes the necessity of contracting debt in time of war. When war comes, there is no money in the treasury but what is necessary for carrying on the ordinary expence of the peace establishment. In war an establishment of three or four times that expence becomes necessary for the defence of the state, and consequently a revenue three or four times greater than the peace revenue. Supposing that the sovereign should have, what he scarce ever has, the immediate means of augmenting his revenue in proportion to the augmentation of his expence; yet still the produce of the taxes, from which this increase of revenue must be drawn, will not begin to come into the treasury till perhaps ten or twelve months after they are imposed. But the moment in which war begins, or rather the moment in which it appears likely to begin, the army must be augmented, the fleets must be fitted out, the garrisoned towns must be put into a posture of defence; that army, that fleet, those garrisoned towns, must be furnished with arms, ammunition, and provisions. An immediate and great expence must be incurred in that moment of immediate danger, which will not wait for the gradual and slow returns of the new taxes. In this exigency government can have no other resources but in borrowing.

The same commercial state of society which, by the operation of moral causes, brings government in this manner into the necessity of borrowing, produces in the subjects both an ability and an inclination to lend. If it commonly brings along with it the necessity of borrowing, it likewise brings along with it the facility of doing so.

A country abounding with merchants and manufacturers, necessarily abounds with a set of people thro' whose hands not only their own capitals, but the capitals of all those who either lend them money or trust them with goods, pass as frequently or more frequently than the revenue of a private man, who without trade or business lives upon his income, passes through his hands. The revenue of such a man can regularly pass through his hands only once in a year. But the whole amount of the capital and credit of a merchant who deals in a trade of which the returns are very quick, may sometimes pass through his hands two, three, or four times in a year. A country abounding with merchants and manufacturers, therefore, necessarily abounds with a set of people who have it at all times in their power to advance, if they choose to do so, a very large sum of money to government. Hence the ability in the subjects of a commercial state to lend.

The progress of the enormous debts which at present oppress, and will in the long run probably ruin, all the great nations of Europe, has been pretty uniform. In England, after the Revolution, when new connections with Europe introduced a new system of foreign politics, the expences of the nation, not only in settling the new establishment, but in maintaining long wars, as principals, on the continent, for the security of the Dutch barrier, reducing the French monarchy, settling the Spanish succession, supporting the house of Austia, maintaining the liberties of the Germanic body, and other purposes, increased to an unusual degree: insomuch, that it was not thought adviseable to raise all the expences of any one year by taxes to be levied within that year, lest the unaccustomed weight of them should create murmurs among the people. It was therefore the policy of the times to anticipate the revenues of their posterity, by borrowing immense sums

Blackst. Comment.

National. ſums for the current ſervice of the ſtate, and to lay no more taxes upon the ſubject than would ſuffice to pay the annual intereſt of the ſums ſo borrowed; by this means converting the principal debt into a new ſpecies of property, transferable from one man to another at any time and in any quantity. This ſyſtem indeed ſeems to have had its original in the ſtate of Florence, A. D. 1344; which government then owed about L. 60,000 Sterling; and being unable to pay it, formed the principal into an aggregate ſum, called metaphorically a *mount* or *bank*, the ſhares whereof were transferable like our ſtocks, with intereſt at 5 *per cent.* the prices varying according to the exigencies of the ſtate. This laid the foundation of what is called the *national debt:* for a few long annuities created in the reign of Charles II. will hardly deſerve that name.

Nations, like private men, have generally begun to borrow upon what may be called *perſonal credit*, without aſſigning or mortgaging any particular fund for the payment of the debt; and when this reſource has failed them, they have gone on to borrow upon aſſignments or mortgages of particular funds.

What is called the *unfunded debt of Great Britain*, is contracted in the former of thoſe two ways. It conſiſts partly in a debt which bears, or is ſuppoſed to bear, no intereſt, and which reſembles the debts that a private man contracts upon account; and partly in a debt which bears intereſt, and which reſembles what a private man contracts upon his bill or promiſſory note. The debts which are due either for extraordinary ſervices, or for ſervices either not provided for or not paid at the time when they are performed; part of the extraordinaries of the army, navy, and ordnance, the arrears of ſubſidies to foreign princes, thoſe of ſeamens wages, &c. uſually conſtitute a debt of the firſt kind. Navy and exchequer bills, which are iſſued ſometimes in payment of a part of ſuch debts, and ſometimes for other purpoſes, conſtitute a debt of the ſecond kind; exchequer bills bearing intereſt from the day on which they are iſſued, and navy bills ſix months after they are iſſued. The bank of England, either by voluntarily diſcounting thoſe bills at their current value, or by agreeing with government for certain conſiderations to circulate exchequer bills, that is, to receive them at par, paying the intereſt which happens to be due upon them, keeps up their value, and facilitates their circulation, and thereby frequently enables government to contract a very large debt of this kind. During the great recoinage in King William's time, when the bank of England thought proper to put a ſtop to its uſual tranſactions, exchequer bills and tallies are ſaid to have ſold from 25 to 60 *per cent.* diſcount; owing partly, no doubt, to the ſuppoſed inſtability of the new government eſtabliſhed by the Revolution, but partly too to the want of the ſupport of the bank of England.

When this reſource is exhauſted, and it becomes neceſſary, in order to raiſe money, to aſſign or mortgage ſome particular branch of the public revenue for the payment of the debt, government has upon different occaſions done this in two different ways. Sometimes it has made this aſſignment or mortgage for a ſhort period of time only, a year or a few years, for example; and ſometimes for perpetuity. In the one caſe, the fund was ſuppoſed ſufficient to pay within the limited time both principal and intereſt of the money borrowed: In the other, it was ſuppoſed ſufficient to pay the intereſt only, or a perpetual annuity equivalent to the intereſt; government being at liberty to redeem at any time this annuity upon paying back the principal ſum borrowed. When money was raiſed in the one way, it was ſaid to be raiſed *by anticipation;* when in the other, *by perpetual funding*, or, more ſhortly, *by funding*. National.

In the reign of King William, when the debt began to be amaſſed, and during a great part of that of Queen Anne, before we had become ſo familiar as we are now with the practice of perpetual funding, the greater part of the new taxes were impoſed but for a ſhort period of time (for four, five, ſix, or ſeven years only), and a great part of the grants of every year conſiſted in loans upon anticipation of the produce of thoſe taxes. The produce being frequently inſufficient for paying within the limited term the principal and intereſt of the money borrowed, deficiencies aroſe; to make good which it became neceſſary to prolong the term.

On the 31ſt of December 1697, the funded and unfunded debts amounted to L. 21,515,742 : 13 : $8\frac{1}{2}$; at the ſame time, in 1714, they were L. 53,681,076, 5s. $6\frac{1}{12}$d. In 1755, before the breaking out of the war, they amounted to L. 72,289,673; and on the 5th of January 1763, at the concluſion of the peace, they had accumulated to L. 122,603,336 : 8 : $2\frac{1}{4}$ of funded debt, and of unfunded L. 13,027,589 : 2 : 2 more. In 1775, they were very nearly 130 millions; and the laſt American war added upwards of 120 millions more to that enormous ſum: to pay the intereſt of which, and the charges of management, amounting annually to nearly eight millions and an half, the extraordinary revenues elſewhere enumerated † (excepting only the land-tax and annual malt-tax) are in the firſt place mortgaged and made perpetual by parliament. Perpetual we ſay; but ſtill redeemable by the ſame authority that impoſed them: which, if it at any time can pay off the capital, will aboliſh thoſe taxes which are raiſed to diſcharge the intereſt.

† See *Revenue*.

By this means, then, the quantity of property in the kingdom is greatly increaſed in idea compared with former times; yet, if we coolly conſider it, not at all increaſed in reality. We may boaſt of large fortunes, and quantities of money in the funds. But where does this money exiſt? It exiſts only in name, in paper, in public faith, in parliamentary ſecurity: and that is undoubtedly ſufficient for the creditors of the public to rely on. But then what is the pledge which the public faith has pawned for the ſecurity of theſe debts? The land, the trade, and the perſonal induſtry of the ſubject; from which the money muſt ariſe that ſupplies the ſeveral taxes. In theſe therefore, and theſe only, the property of the public creditors does really and intrinſically exiſt; and of courſe the land, the trade, and the perſonal induſtry of individuals, are diminiſhed in their true value juſt ſo much as they are pledged to anſwer. If A's income amounts to L. 100 *per annum;* and he is ſo far indebted to B, that he pays him L. 50 *per annum* for his intereſt; one half of the value of A's property is transferred to B the creditor. The creditor's property exiſts in the demand which he has upon the debtor, and no where elſe; and the debtor is only a truſtee to his creditor for one half

of the value of his income. In ſhort, the property of a creditor of the public conſiſts in a certain portion of the national taxes; by how much therefore he is the richer, by ſo much the nation, which pays theſe taxes, is the poorer.

The only advantage that can reſult to a nation from public debts, is the increaſe of circulation, by multiplying the caſh of the kingdom, and creating a new ſpecies of currency, aſſignable at any time and in any quantity; always therefore ready to be employed in any beneficial undertaking, by means of this its transferable quality; and yet producing ſome profit even when it lies idle and unemployed. A certain proportion of debt ſeems to be highly uſeful to a trading people; but what that proportion is, it is not for us to determine. This much is indiſputably certain, that the preſent magnitude of our national incumbrances very far exceeds all calculations of commercial benefit, and is productive of the greateſt inconveniences. For, firſt, the enormous taxes that are raiſed upon the neceſſaries of life for the payment of the intereſt of this debt, are a hurt both to trade and manufactures, by raiſing the price as well of the artificer's ſubſiſtence as of the raw material, and of courſe, in a much greater proportion, the price of the commodity itſelf. Nay, the very increaſe of paper-circulation itſelf, when extended beyond what is requiſite for commerce or foreign exchange, has a natural tendency to increaſe the price of proviſions as well as of all other merchandiſe. For as its effect is to multiply the caſh of the kingdom, and this to ſuch an extent that much muſt remain unemployed, that caſh (which is the univerſal meaſure of the reſpective values of all other commodities) muſt neceſſarily ſink in its own value, and every thing grow comparatively dearer. Secondly, if part of this debt be owing to foreigners, either they draw out of the kingdom annually a conſiderable quantity of ſpecie for the intereſt; or elſe it is made an argument to grant them unreaſonable privileges in order to induce them to reſide here. Thirdly, if the whole be owing to ſubjects only, it is then charging the active and induſtrious ſubject, who pays his ſhare of the taxes to maintain the indolent and idle creditor who receives them. Laſtly, and principally, it weakens the internal ſtrength of a ſtate, by anticipating thoſe reſources which ſhould be reſerved to defend it in caſe of neceſſity. The intereſt we now pay for our debts would undoubtedly be ſufficient to maintain the moſt vigorous war that any national motives could poſſibly require. If indeed our anceſtors in King William's time had annually paid, ſo long as their exigencies laſted, a far leſs ſum than we now annually raiſe upon their accounts, they would not in time of war have borne ſo great burdens as they have bequeathed to and ſettled upon their poſterity in time of peace; and might have been eaſed the inſtant the exigence was over. See FUNDS.

On the whole, then, the national debt is undoubtedly a ſubject of vaſt importance, and as ſuch it has been always conſidered; for much has been ſaid and written upon it, and many ſchemes have been propoſed at various times and by various perſons for gradually removing it, it being conſidered by the moſt judicious as a moſt pernicious incumbrance to a commercial country. Some, we are aware, think it of vaſt utility; but this opinion is too eccentric, and in our eſtimation too feebly ſupported, to be convincing. The public debt is indiſputably a great grievance; and every lover of his country muſt ſurely wiſh to ſee it removed: the period, however, when this bleſſing ſhall take place, if indeed it ever arrive, muſt at leaſt be very diſtant.

It is neither our buſineſs nor intention (even if the limits preſcribed to the article did not prevent it) to be minute on the ſubject, or to propoſe any ſchemes for alleviating the burdens of the nation. That indeed has been already done by far abler hands than we profeſs to be: we muſt therefore refer ſuch as wiſh for farther information on this intereſting topic to thoſe (and they are not a few) who have treated of it at full length. Smith's Wealth of Nations, and Sir John Sinclair's Hiſtory of the Revenue, go to the bottom of the matter. The writings of Dr Price likewiſe deſerve conſiderable attention, eſpecially as one of his plans for the reduction of the debt has in fact been adopted, and in conſequence eſtabliſhed, by the legiſlature: His three plans may be found in a late pamphlet by William Morgan, intitled, A Review of Dr Price's Writings on the Subject of the Finances of this Kingdom.

NATIVITY, or NATAL DAY, the day of a perſon's birth. The word *nativity* is chiefly uſed in ſpeaking of the ſaints; as, the nativity of St John the Baptiſt, &c. But when we ſay *the* Nativity, it is underſtood of that of Jeſus Chriſt, or the feaſt of Chriſtmas.

NATIVITY, *nativitas*, in ancient law-books, ſignifies bondage or ſervitude.

NATIVITY, in aſtrology, the theme or figure of the heavens, and particularly of the twelve houſes, at the moment when a perſon was born; called alſo the *horoſcope*.

Caſting the nativity, or by calculation ſeeking to know how long the queen ſhould live, &c. was made felony, an. 23 Eliz. c. 2.

NATIVO HABENDO, in law, a writ directed to the ſheriff, for a lord who claimed inheritance in any villain, when a villain was run away from him, for the apprehending and reſtoring him to the lord.

NATIX, in natural hiſtory, a name given by ſome old writers to the *nerita*.

NATOLIA, the modern name of the Leſſer Aſia, being the moſt weſterly part of Turkey in Aſia, and conſiſting of a large peninſula, which extends from the river Euphrates as far as the Archipelago, the ſeas of Marmora, the ſtraits of Galipoli and of Conſtantinople, which ſeparate it from Europe on the weſt. It is bounded on the north by the Black ſea, and on the ſouth by the Mediterranean.

NATRIX, in botany, the name given by Rivinius to a genus of plants nearly allied to the anonis, and comprehended with it in one genus by Linnæus, under the name of anonis. See *REST-harrow*.

NATRIX, in zoology, the name of the common or water-ſnake, called alſo *torquata*, from the ring about its neck. It is not a water animal, properly ſpeaking, but a land one, which being able to ſwim very well, often takes the water to hunt about for frogs, which are its principal food. It grows to be much longer and larger than the viper, and does not bring forth live young ones, but great numbers of eggs, which it lays in dung-

Natrum || Natural.

dunghills to be hatched by the warmth of the place, or by the heat of the sun.

NATRUM, the nitre of the ancients, in natural history, is a genuine, pure, and native salt, extremely different from our nitre, and indeed from all the other native salts, it being a fixed alkali, plainly of the nature of those made by fire from vegetables, yet capable of a regular crystallization, which those salts are not. It is found on the surface of the earth, or at very small depths within it; and is naturally formed into thin and flat cakes or crusts, which are of a spungy or cavernous substance, very light and friable, and, when pure, of a pale brownish white; but as its spungy texture renders it very subject to be fouled by earth received into its pores, it is often met with of a deep dirty brown, and not unfrequently reddish.

Natrum, whether native or purified, dissolves in a very small quantity of water; and this solution is, in many parts of Asia, used for washing; where it is also made into soap, by mixing it with oil. Natrum reduced to powder, and mixed with sand or flints, or with any other stone of which crystal is the basis, make them readily run into glass. Gold heated red-hot, and sprinkled with a small quantity of this salt, melts in the same manner; as does also iron, copper, and the regulus of antimony; which melt much more easily than they otherwise would do. Mercury cannot be mixed with it by any art, and indeed will not amalgamate with metals if only a little of this salt be added. It is found in great abundance in many parts of Asia, where the natives sweep it up from the surface of the ground, and call it *soap-earth*. The earliest account we have of it is in the scriptures, where we find that the salt called *nitre* in those times would ferment with vinegar, and had an abstersive quality, so that it was used in baths and in washing things. Solomon compares the singing of songs with a heavy heart, to the contrariety of vinegar and nitre; and Jeremiah says, that if the sinner wash himself with nitre, his sin is not cleansed off. These are properties that perfectly agree with this salt, but not at all with our saltpetre.

NATTER-JACK, in zoology, a species of RANA.

NATURAL, in general, something that relates to nature. See NATURE.

NATURAL Children, are those born out of lawful wedlock. See BASTARD.

NATURAL Functions, are those actions whereby the aliments are changed and assimilated so as to become a part of the body.

NATURAL, in heraldry, is used where animals, fruits, flowers, &c. are blazoned with the colours they naturally have, though different from the common colours of heraldry: and this is to prevent their armories being accused of falsity, when blazoned with the names of colours unknown in heraldry.

NATURAL Note, in music, is used in opposition to flat and sharp notes, which are called *artificial notes*. See NOTE, SCALE, &c.

NATURAL is also used for something coming immediately out of the hands of nature: in which sense it stands opposed to *factitious* or artificial, which signifies something wrought by art. See ARTIFICIAL.

Bishop Wilkins observes, that there appears a world of difference between natural and artificial things, when viewed with microscopes. The first ever appear adorned with all imaginable elegance and beauty; the latter, though the most curious in their kind, infinitely rude and unhewn: the finest needle appears a rough bar of iron; and the most accurate engraving or embossment, as if done with a mattock or a trowel.

NATURAL Beauty, or the beauty of natural objects, is that quality or those qualities in the works of nature, or more properly of God, which are calculated to excite pleasing sensations in the minds of all such persons of true taste as attentively observe them. It will not, we trust, be deemed improper or impertinent, therefore, to introduce a few observations on this subject, previous to our treating of natural history.—To many, it is hoped, it will appear to be a very proper introduction to that important article. "That sensibility to beauty, which, when cultivated and improved, we term taste, is universally diffused through the human species†; and it is most uniform with respect to those objects, which being out of our power are not liable to variation from accident, caprice, or fashion. The verdant lawn, the shady grove, the variegated landscape, the boundless ocean, and the starry firmament, are contemplated with pleasure by every attentive beholder. But the emotions of different spectators, though similar in kind, differ widely in degree; and to relish with full delight the enchanting scenes of nature, the mind must be uncorrupted by avarice, sensuality, or ambition; quick in her sensibilities; elevated in her sentiments; and devout in her affections. He who possesses such exalted powers of perception and enjoyment, may almost say, with the poet,

† Dr Percival's *Moral and Literary Dissertations*.

I care not, Fortune! what you me deny;
You cannot rob me of free Nature's grace;
You cannot shut the windows of the sky,
Through which Aurora shows her bright'ning face;
You cannot bar my constant feet to trace
The woods and lawns, by living stream, at eve:
Let health my nerves and finer fibres brace,
And I their toys to the great children leave:
Of fancy, reason, virtue, nought can me bereave.

"Perhaps such ardent enthusiasm may not be compatible with the necessary toils and active offices which Providence has assigned to the generality of men. But there are none to whom some portion of it may not prove advantageous; and if it were cherished by each individual, in that degree which is consistent with the indispensable duties of his station, the felicity of human life would be considerably augmented. From this source, the refined and vivid pleasures of the imagination are almost entirely derived: and the elegant arts owe their choicest beauties to a taste for the contemplation of nature. Painting and sculpture are express imitations of visible objects; and where would be the charms of poetry, if divested of the imagery and embellishments which she borrows from rural scenes? Painters, statuaries, and poets, therefore, are always ambitious to acknowledge themselves the pupils of nature; and as their skill increases, they grow more and more delighted with every view of the animal and vegetable world. But the pleasure resulting from admiration is transient; and to cultivate taste, without regard

regard to its influence on the paffions and affection, 'is to rear a tree for its bloffoms, which is capable of yielding the richeft and moft valuable fruit.' Phyfical and moral beauty bear fo intimate a relation to each other, that they may be confidered as different gradations in the fcale of excellence: and the knowledge and relifh of the former fhould be deemed only a ftep to the nobler and more permanent enjoyments of the latter.

"Whoever has vifited the Leafowes, in Warwickfhire, muft have felt the force and propriety of an infcription which meets the eye at the entrance into thofe delightful grounds.

Would you then tafte the tranquil fcene?
Be fure your bofoms be ferene:
Devoid of hate, devoid of ftrife,
Devoid of all that poifons life:
And much it 'vails you, in their place,
To graft the love of human race.

"Now fuch fcenes contribute powerfully to infpire that ferenity which is neceffary to enjoy and to heighten their beauties. By a fecret contagion, the foul catches the harmony which fhe contemplates; and the frame within affimilates itfelf to that which is without. For,

Who can forbear to fmile with Nature? Can
The ftormy paffions in the bofom roll,
While every gale is peace, and every grove
Is melody?

"In this ftate of fweet compofure, we become fufceptible of virtuous impreffions, from almoft every furrounding object. The patient ox is viewed with generous complacency; the guilelefs fheep with pity; and the playful lamb raifes emotions of tendernefs and love. We rejoice with the horfe, in his liberty and exemption from toil, while he ranges at large through enamelled paftures; and the frolics of the colt would afford unmixed delight, did we not recollect the bondage which he is foon to undergo. We are charmed with the fong of birds, foothed with the buzz of infects, and pleafed with the fportive motions of fifhes, becaufe thefe are expreffions of enjoyment; and we exult in the felicity of the whole animated creation. Thus an equal and extenfive benevolence is called forth into exertion; and having felt a common intereft in the gratifications of inferior beings, we fhall be no longer indifferent to their fufferings, or become wantonly inftrumental in producing them.

"It feems to be the intention of Providence, that the lower order of animals fhould be fubfervient to the comfort, convenience, and fuftenance of man. But his right of dominion extends no farther; and if this right be exercifed with mildnefs, humanity, and juftice, the fubjects of his power will be no lefs benefited than himfelf. For various fpecies of living creatures are annually multiplied by human art, improved in their perceptive powers by human culture, and plentifully fed by human induftry. The relation, therefore, is reciprocal between fuch animals and man; and he may fupply his own wants by the ufe of their labour, the produce of their bodies, and even the facrifice of their lives, whilft he co-operates with all-gracious Heaven in promoting happinefs, the great end of exiftence.

"But though it be true, that partial evil, with refpect to different orders of fenfitive beings, may be univerfal good; and that it is a wife and benevolent inftitution of nature, to make deftruction itfelf, within certain limitations, the caufe of an increafe of life and enjoyment; yet a generous perfon will extend his compaffionate regards to every individual that fuffers for his fake: and, whilft he fighs

Even for the kid or lamb that parts its life
Beneath the bloody knife,

he will naturally be folicitous to mitigate pain, both in duration and degree, by the gentleft modes of inflicting it.

"We are inclined to believe, however, that this fenfe of humanity would foon be obliterated, and that the heart would grow callous to every foft impreffion, were it not for the benignant influence of the fmiling face of nature. The count de Lauzun, when imprifoned by Louis XIV. in the caftle of Pignerol, amufed himfelf during a long period of time with catching flies, and delivering them to be devoured by a rapacious fpider. Such an entertainment was equally fingular and cruel; and inconfiftent, we believe, with his former character, and his fubfequent turn of mind. But his cell had no window, and received only a glimmering light from an aperture in the roof. In lefs unfavourable circumftances, may we not prefume, that inftead of fporting with mifery, he would have releafed the agonifing flies, and bid them enjoy that freedom of which he himfelf was bereaved?

"But the tafte for natural beauty is fubfervient to higher purpofes than thofe which have been enumerated: and the cultivation of it not only refines and humanifes, but dignifies and exalts the affections. It elevates them to the admiration and love of that Being who is the author of all that is fair, fublime, and good in the creation. Scepticifm and irreligion are hardly compatible with the fenfibility of heart which arifes from a juft and lively relifh of the wifdom, harmony, and order fubfifting in the world around us: and emotions of piety muft fpring up fpontaneoufly in the bofom that is in unifon with all animated nature. Actuated by this divine infpiration, man finds a fane in every grove; and, glowing with devout fervour, he joins his fong to the univerfal chorus, or mufes the praife of the Almighty, in more expreffive filence. Thus they

Whom Nature's works can charm, with God himfelf
Hold converfe; grow familiar, day by day,
With his conceptions; act upon his plan;
And form to his, the relifh of their fouls."

On the whole then, it certainly appears, that the advantages refulting from a tafte for natural beauties are great and important: it is equally certain, that as it is ufeful, fo it is a continual fource of real enjoyment; for a more rational pleafure cannot poffibly occupy the attention or captivate the affections of mankind, than that which arifes from a due confideration of the works of nature. Pleafure, we know, is a neceffary ingredient in human life, in order in fome meafure to counterbalance the pains, the evils, and liftleffneffes, which are at times perhaps unavoidable, and in order to render life tolerable. It is the part then of

the

Natural. the moralist, and it has been frequently his business, to point out and recommend such pleasures as are highly gratifying, and are yet perfectly innocent. The Spectator, whose works will be admired as long as the language in which they are written is understood, recommends strongly and elegantly the pleasure of a garden; and a later writer*, of no common degree of merit, and of very considerable fame, has an essay on the same subject, from which we shall select a few observations, and so conclude the article. "Not he alone (says this elegant writer) is to be esteemed a benefactor to mankind, who makes an useful discovery; but he also who can point out and recommend an innocent pleasure. Of this kind are the pleasures arising from the observation of nature; and they are highly agreeable to every taste uncorrupted by vicious indulgence. Rural scenes of almost every kind are delightful to the mind of man. But the misfortune is, that the greater part are hurried on in the career of life with too great rapidity to be able to give attention to that which solicits no passion. The darkest habitation in the dirtiest street of the metropolis, where money can be earned, has greater charms with many than the groves of Hagley.

* Knox.

"The patron of refined pleasure, the elegant Epicurus, fixed the seat of his enjoyment in a garden. He was of opinion, that a tranquil spot, furnished with the united sweets of art and nature, was the best adapted to delicate repose. And even the severer philosophers of antiquity were wont to discourse in the shade of a spreading tree, in some cultivated plantation. It is obvious, on intuition, that nature often intended solely to please the eye in her vegetable productions. She decorates the flowret that springs beneath our feet in all the perfections of external beauty. She has clothed the garden with a constant succession of various hues. Even the leaves of the tree undergo a pleasing vicissitude. The fresh verdure which they exhibit in the spring, the various shades which they assume in summer, the yellow and russet tinge of autumn, and the nakedness of winter, afford a constant pleasure to a lively imagination. From the snow-drop to the moss-rose, the flower garden displays an infinite variety of shape and colour. The taste of the florist has been ridiculed as trifling; yet surely without reason. Did nature bring forth the tulip and the lily, the rose and the honeysuckle, to be neglected by the haughty pretender to superior reason? To omit a single social duty for the cultivation of a polyanthus were ridiculous as well as criminal; but to pass by the beauties lavished before us, without observing them, is no less ingratitude than stupidity. A bad heart finds little amusement but in a communication with the active world, where scope is given for the indulgence of malignant passions; but an amiable disposition is commonly known by a taste for the beauties of the animal and the vegetable creation." In short, since the world was made for our use, since the beauties of nature are alike displayed before all men, and since they are unquestionably an inexhaustible fund of innocent amusement; that subject must be of vast importance which enables us to relish them properly.

NATURAL HISTORY.

NATURAL HISTORY, in its most extensive signification, denotes a knowledge and description of the whole universe. Matters of fact respecting the heavens, meteors, the atmosphere, the earth, respecting all the phenomena, indeed, which occur in the world, and even of the external parts and actions of man himself, as far as reason can discover them, belong to the province of natural history; but when we leave the simple recital of effects, and endeavour to investigate the causes of such and such phenomena, we then leave natural history, and enter on philosophy. The object of our article, therefore, in the sense we have here given it, is as extensive as nature itself. But, in its more appropriated sense, it is well known that its province only extends to the surface of the earth, the works on it, and the inhabitants of it. It treats of those substances of which, as far as our researches have led us, the earth is composed, and of those organized bodies, whether vegetable or animal, which adorn its surface, which rise into the air, or live in the bosom of the waters.—But as a science so various and comprehensive could neither with propriety nor advantage be completely discussed under the general title, we have to refer the reader to the article KINGDOMS *(in Natural History)*, where he will be directed to the different articles which constitute either the branches or the objects of the science, and which are all treated under their respective names. In the present article it is proposed to give a general and philosophical view of the subject: To set forth, in a summary way, whatever curious, worthy to be known, or not obvious to every observer, occurs in the three kingdoms of nature: with their constitution, laws, and œconomy; or, in other words, that all-wise disposition of the Creator in relation to natural things, by which they are fitted to produce general ends and reciprocal uses.

SECT. I. *Of the Terraqueous Globe in general, and its changes.*

THE world, or the terraqueous globe, which we inhabit, is every-where surrounded with elements, and contains in its superficies the three KINGDOMS *of Nature*, as they are called: the fossil, which constitutes the crust of the earth; the vegetable, which adorns the face of it, and draws the greatest part of its nourishment from the fossil kingdom; and the animal, which is sustained by the vegetable kingdom. Thus, then, these three grand divisions, or, as they are commonly called, kingdoms; cover, adorn, and vary, the surface of the earth.

As to the STRATA of the EARTH and MOUNTAINS, as far as we have hitherto been able to discover, the upper parts consist of rag-stone; the next of slate; the third of marble filled with petrifactions; the fourth again, of slate; and lastly, the lowest of free stone.—

The

Of the Terraqueous Globe.

The habitable part of the earth, though it is fcooped into various inequalities, yet is every-where high in comparifon with the water; and the farther it is from the fea it is generally higher. Thus the waters in the lower places are not at reft, unlefs fome obftacle confines them, and by that means form lakes and marfhes.

The SEA furrounds the continent, and takes up the greateft part of the earth's furface, as geographers inform us. Nay, that it once fpread over much the greateft part, we may be convinced by its yearly decreafe, by the rubbifh left by the tides, by fhells, ftrata, and other circumftances.

The fea-fhores are ufually full of dead teftaceous animals, wreck, and fuch like bodies, which are yearly thrown out of the fea. They are alfo covered with fand of various kinds, ftones, &c. It happens, moreover, that while the more rapid rivers rufh through narrow valleys, they wear away the fides; and thus the friable and foft earth falls in, and its ruins are carried to diftant and winding fhores; whence it is certain, that the continent gains no fmall increafe, as the fea fubfides.

The CLOUDS collected from exhalations, chiefly from the fea, but likewife from other waters, and moift grounds, and condenfed in the lower regions of the ATMOSPHERE, fupply the earth with RAIN; but fince they are attracted by the mountainous parts of the earth, it neceffarily follows, that thofe parts muft have, as is fit, a larger fhare of water than the reft. SPRINGS, which generally rufh out at the foot of mountains, take their rife from this very rain-water, and vapours condenfed, that trickle through the holes and interftices of loofe bodies, and are received into caverns.

Thefe afford a pure WATER purged by ftraining; and rarely dry up in fummer, or freeze in winter, fo that animals never want a wholefome and refrefhing liquor.

The chief fources of RIVERS are fountains and rills growing by gradual fupplies into ftill larger and larger ftreams; till at laft, after the conflux of a vaft number of them, they find no ftop, but falling into the fea with much rapidity, they there depofit the united ftores they have gathered, along with foreign matter, and fuch earthy fubftances as they tore off in their way. Thus the water returns in a circle whence it firft drew its origin, that it may act over the fame fcene in continued fucceffion.

Marfhes arifing from water retained in low grounds, are filled with moffy tumps, which are brought down by the water from the higher parts, or are produced by putrified plants.

We often fee new meadows arife from marfhes dried up. This happens fooner when the *fphagnum* (a kind of mofs) has laid a foundation; for this in procefs of time changes into a very porous mould, till almoft the whole marfh is filled with it. After that the rufh ftrikes root, and along with the cotton-graffes conftitutes a turf, raifed in fuch a manner that the roots get continually higher, and thus lay a more firm foundation for other plants, till the whole marfh is changed into a fine and delightful meadow; efpecially if the water happens to work itfelf a new paffage.

Hillocks, that abound in low grounds, occafion the earth to increafe yearly, more than the countryman would wifh, and feem to do hurt: but in this the great induftry of nature deferves to be taken notice of. For by this means the barren fpots become fooner rich meadow and pafture-land. Thefe hillocks are formed by the ant, by ftones and roots, and the trampling of cattle: but the principal caufe is the force of the winter-cold, which in the fpring raifes the roots of plants fo high above the ground, that being expofed to the air, they grow, and perifh; after which the golden maidenhairs fill the vacant places.

Mountains, hills, valleys, and all the inequalities of the earth, though fome think they take away much from its beauty, are fo far from producing fuch an effect, that on the contrary they give a more pleafing afpect, and confer great advantages. For thus the terreftrial fuperficies is larger; different kinds of plants thrive better, and are more eafily watered; and the rain-waters run in continual ftreams into the fea; not to mention many other ufes in relation to winds, heat, and cold. Alps are the higheft mountains, that reach to the fecond region of the air, where trees cannot grow erect. The higher thefe Alps are, the colder they are *cæteris paribus*. Hence the Alps in Sweden, Siberia, Swifferland, Peru, Brafil, Armenia, Afia, Africa, are perpetually covered with fnow, which becomes almoft as hard as ice. But if by chance the fummer heats be greater than ordinary, fome part of thefe ftores melts, and runs through rivers into the lower regions, which by this means are much refrefhed.

It is fcarcely to be doubted, but that the rocks and ftones difperfed over the globe were formed originally in, and from, the earth; but when torrents of rain have foftened, as they eafily do, the foluble earth, and carried it down into the lower parts, we imagine it happens, that thefe folid and heavy bodies, being laid bare, ftick out above the furface. We might alfo take notice of the wonderful effect of the tide, fuch as we fee happen from time to time on the fea-fhore, which being daily and nightly affaulted with repeated blows, at length gives way, and breaks off. Hence we fee in moft places the rubbifh of the fea, and fhores.

The winter by its froft prepares the earth and mould, which thence are broken into very minute particles, and thus, being put into a mouldering ftate, become more fit for the nourifhment of plants; nay, by its fnow it covers the feeds and roots of plants, and thus by *cold* defends them from the *force of cold*. We muft add alfo, that the piercing froft of the winter purifies the atmofphere and putrid waters, and makes them more wholefome for animals.

The perpetual fucceffion of heat and cold with us renders the fummers more pleafing: and tho' the winter deprives us of many plants and animals, yet the perpetual fummer within the tropics is not much more agreeable, as it often deftroys men and other animals by its immoderate heat; though it muft be confeffed, that thofe regions abound with exquifite fruits. Our winters though very troublefome to a great part of the globe on account of their vehement and intenfe cold, yet are lefs hurtful to the inhabitants of the northern parts, as experience teftifies. Hence it happens,

Of the Terraqueous Globe.

Of the Seasons. pens, that we may live very conveniently on every part of the earth, as every different country has different advantages from nature.

The ſeaſons, like every thing elſe, have their viciſſitudes; their beginnings, their progreſs, and their end.

The age of man begins from the cradle; pleaſing childhood ſucceeds; then active youth; afterwards manhood, firm, ſevere, and intent upon ſelf-preſervation; laſtly, old age creeps on, debilitates, and at length totally deſtroys our tottering bodies.

The ſeaſons of the year proceed in the ſame way. Spring, the jovial, playful infancy of all living creatures, repreſents childhood and youth; for then plants ſpread forth their luxuriant flowers, fiſhes exult, birds ſing, every part of nature is intent upon generation. The ſummer, like middle age, exhibits plants, and trees every where cloathed with green; it gives vigour to animals, and plumps them up; fruits then ripen, meadows look cheerful, every thing is full of life. On the contrary, autumn is gloomy; for then the leaves of trees begin to fall, plants to wither, inſects to grow torpid, and many animals to retire to their winter-quarters.

The day proceeds with juſt ſuch ſteps as the year. The morning makes every thing alert, and fit for buſineſs: the ſun pours forth his ruddy rays; the flowers, which had as it were ſlept all night, awake and expand themſelves again; the birds with their ſonorous voices and various notes make the woods ring, meet together in flocks, and ſacrifice to Venus. Noon tempts animals into the fields and paſtures; the heat puts them upon indulging their eaſe, and even neceſſity obliges them to it. Evening follows, and makes every thing more ſluggiſh; flowers ſhut up *, and animals retire to their lurking places. Thus the ſpring, the morning, and youth, are proper for generation; the ſummer, noon, and manhood, are proper for preſervation; and autumn, evening, and old age, are not unfitly likened to deſtruction.

* See Vigils of Plants.

In order to perpetuate the eſtabliſhed courſe of nature in a continued ſeries, the Divine Wiſdom has thought fit that all living creatures ſhould conſtantly be employed in *producing* individuals; that all natural things ſhould contribute and lend a helping hand towards *preſerving* every ſpecies; and laſtly, that the *death* and *deſtruction* of one thing ſhould always be ſubſervient to the production of another. Hence the objects of our preſent inquiry fall to be conſidered in a threefold view, that of *propagation*, *preſervation*, and *death* or *deſtruction*.

Sect. II. *The Foſſil Kingdom.*

I. Propagation.

It is agreed on all hands, that ſtones are not organical bodies, like plants and animals; and therefore it is as clear that they are not produced from an egg, like the tribes of the other kingdoms. Hence the variety of foſſils is proportionate to the different combinations of coaleſcent particles; and hence the ſpecies in the foſſil kingdom are not ſo diſtinct as in the other two. Hence alſo the laws of generation in relation to foſſils have been in all ages extremely difficult to explain; and laſtly, hence have ariſen ſo many different opinions about them, that it would be endleſs to enumerate them all. We therefore, for the preſent, ſhall content ourſelves with giving a very few obſervations on this ſubject.

Foſſil Kingdom.

Some people ſuppoſe that clay is the ſediment of the ſea; and obſervation ſo far ſeems to go along with this opinion, for great plenty of it is generally found along the coaſts. Seamen who have been ſo accurate as to keep journals, have obſerved, that a very minute ſand covers the bottom of the ocean; and ſeem to think that it is daily cryſtallized from the water. It is now generally acknowledged, that teſtaceous bodies and petrifactions reſembling animals were once real animals or vegetables. It has been ſuppoſed indeed, that ſhells, being of a calcareous nature, changed the adjacent clay, ſand, or mould, into the ſame kind of ſubſtance. Hence it appears certain, that marbles may be generated from petrifactions; and therefore it is often full of them. Rag-ſtone, the common matter of our rocks, appears to be formed from a ſandy kind of clay; moſt frequently, however, this appears to happen where the earth is impregnated with iron. Free-ſtone ſeems to be the product of ſand; and the deeper the bed where it is found, the more compact it becomes; and the more denſe the ſand, the more eaſily it concretes. But if an alkaline clay chances to be mixed with the ſand, the freeſtone is generated more readily, as in that called *cos friatilis particulis argilloglarenſis*. The flint is almoſt the only kind of ſtone, certainly the moſt common, in chalky mountains.—It would appear therefore from this to be produced from chalk: but whether it can be reduced to chalk again, is left for others to enquire.

Stalactites, or drop-ſtone, is compoſed f calcareous particles, adhering to a dry, and generally a vegetable body, and is depoſited by dropping water; from which circumſtance it ſeems to have derived its vulgar name.

Incruſtations (Syſt. Nat. 32. 5. 6. 7. 8.) are, in general, it appears, generated where a vitriolic water connects clayey and earthy particles together.

Slate, by the vegetables that are often incloſed in it, ſeems to take its origin from a marſhy mould.

Metals vary according to the nature of the matrix in which they adhere; *e. g.* the pyrites cupri Fahlumenus contains frequently ſulphur, arſenic, iron, copper, a little gold, vitriol, alum, ſometimes lead-ore, ſilver, and zinc. Thus gold, copper, iron, zinc, arſenic, pyrites, vitriol, come out of the ſame vein. That very rich iron-ore at Normark in Vermilandia, where it was cut tranſverſely by a vein of clay, was changed into pure ſilver. The number therefore of ſpecies and varieties of foſſils, each ſerving for different purpoſes according to their different natures, will be in proportion as the different kinds of earths and ſtones are variouſly combined.

II. Preservation.

As foſſils are deſtitute of life and organization, are hard, and not obnoxious to putrefaction; ſo they laſt longer than any other kind of bodies. How far the air contributes to this duration, it is eaſy to perceive; ſince air hardens many ſtones upon the ſur-

Fossil Kingdom.

face of the earth, and makes them more solid, compact, and able to resist the injuries of time. Thus it is known from vulgar observation, that lime that has been long exposed to the air becomes hardened. The chalky marl which they use in Flanders and about Bath for building houses, as long as it continues in the quarry is friable; but when dug up and exposed to the air it grows gradually harder.

However ignorant we may be of the cause why large rocks are every-where to be seen split, whence vast fragments are frequently torn off; yet we may observe, that fissures are closed up by water, which gets between them, and is detained there; forming crystal and spar. Hence we scarcely ever find any crystal, but in those stones which have retained for some time in its chinks, water loaded with stony particles. In the same manner crystal fills the cavities in mines, and concrete into quartz or a debased crystal.

It is manifest that stones are not only generated, augmented, and changed perpetually, from incrustations brought upon moss, but are also increased by crystal and spar. Not to mention that the adjacent earth, especially if it be impregnated with iron particles, is commonly changed into a solid stone.

It is said, that the marble quarries in Italy, from whence fragments are cut, grow up again. Ores grow by little and little, whenever the mineral particles, conveyed by the means of water through the clefts of mountains, are retained there; so that, adhering to the homogeneous matter a long while, at last they take its nature, and are changed into a similar substance.

III. Destruction.

Fossils, although they are the hardest of bodies, yet are found subject to the laws of destruction, as well as all other created substances. For they are dissolved in various ways by the elements exerting their force upon them; as by water, air, and the solar rays; as also by the rapidity of rivers, violence of cataracts, and eddies, which continually beat upon, and at last reduce to powder the hardest rocks. The agitations of the sea, and lakes, and the vehemence of the waves, excited by turbulent winds, pulverise stones, as evidently appears by their roundness along the shore. Nay, as the poet says,

The hardest stone insensibly gives way
To the soft drops that frequent on it play.

So that we ought not to wonder that these very hard bodies moulder away into powder, and are obnoxious like others to the consuming tooth of time.

Sand is formed of free-stone, which is destroyed partly by frost, making it friable; partly by the agitation of water and waves, which easily wear away, dissolve, and reduce into minute particles what the frost had made friable.

Chalk is in general supposed to be formed of rough marble, which the air, the sun, and the winds have dissolved. The slate earth, or humus schisti, (Syst. Nat. 512.) owes its origin to slate, showers, air, and snow melted.

Ochre is formed of metals dissolved, and presents the very same colours which we always find the ore tinged with when exposed to the air. Vitriol in the same manner mixes with water from ore destroyed.

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The muria saxatilis (Syst. Nat. 14. 6), a kind of talky stone, yielding salt in the parts that are turned to the sun, is dissolved into sand, which falls by little and little upon the earth till the whole is consumed; not to mention other kinds of fossils. Lastly, from these there arise new fossils, as we mentioned before; so that the destruction of one thing serves for the generation of another.

Testaceous worms ought not to be passed over on this occasion, for they eat away the hardest rocks. That species of shell fish called the *razor-shell* bores through stones in Italy, and hides itself within them; so that the people who eat them are obliged to break the stones before they can come at them. The cochlea, (*Faun. Suec.* 1299.) a kind of snail that lives on craggy rocks, eats and bores through the chalky hills, as worms do through wood. This is made evident by the observations of the celebrated de Geer.

It ought to be observed here, that there are often found dead insects in the hearts of the hardest rocks, without any visible trace of the manner of their getting there; from whence many have supposed that stones were originally fluid. Concerning such matters, about which we have but little data, there will always be a great diversity of opinions. It is not our business, at least in this place, to give an opinion on a doubtful subject: the fact is so; of the cause let others judge.

Sect. III. *The Vegetable Kingdom.*

1. Propagation.

Anatomy abundantly proves, that all plants are organic and living bodies; and that all organic bodies are propagated from an egg has been sufficiently demonstrated by the industry of modern writers. We therefore the rather, according to the opinion of the skilful, reject the equivocal generation of plants; and the more so, as it is certain that every living thing is produced from an egg. Now the seeds of vegetables are called *eggs;* these are different in every different plant, that the means being the same, each may multiply its species, and produce an offspring like its parent. We do not deny, that very many plants push forth from their roots fresh offsets for two or more years. Nay, not a few plants may be propagated by branches, buds, suckers, and leaves, fixed in the ground, as likewise many trees. Hence their stems being divided into branches, may be looked on as roots above ground; for in the same way the roots creep under ground, and divide into branches. And there is the more reason for thinking so, because we know that a tree will grow in an inverted situation, *viz.* the roots being placed upwards, and the head downwards, and buried in the ground; for then the branches will become roots, and the roots will produce leaves and flowers. The lime-tree will serve for an example, on which gardeners have chiefly made an experiment. Yet this by no means overturns the doctrine, that all vegetables are propagated by seeds; since it is clear, that in each of the foregoing instances nothing vegetates but what

was

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was the part of a plant, formerly produced from ſeed; ſo that, accurately ſpeaking, without ſeed no new plant is produced

Thus again plants produce ſeeds; but they are entirely unfit for propagation, unleſs fecundation precedes, which is performed by an intercourſe between different ſexes, as experience teſtifies. Plants therefore muſt be provided with organs of generation; in which reſpect they are analogous to animals.—Since in every plant the flower always precedes the fruit, and the fecundated ſeeds viſibly ariſe from the fruit; it is evident that the organs of generation are contained in the flower, which organs are called *antheræ* and *ſtigmata*, and that the impregnation is accompliſhed within the flower. This impregnation is performed by means of the duſt of the antheræ falling upon the moiſt ſtigmata, where the duſt adheres, is burſt, and ſends forth a very ſubtle matter, which is abſorbed by the ſtyle, and is conveyed down to the rudiments of the ſeed, and thus renders it fertile. When this operation is over, the organs of generation wither and fall, nay a change in the whole flower enſues. We muſt, however, obſerve, that in the vegetable kingdom one and the ſame flower does not always contain the organs of generation of both ſexes, but oftentimes the male organs are on one plant and the female on another. But that the buſineſs of impregnation may go on ſucceſsfully, and that no plant may be deprived of the neceſſary duſt, the whole moſt elegant apparatus of the antheræ and ſtigmata in every flower is contrived with wonderful wiſdom.

For in moſt flowers the ſtamina ſurround the piſtils, and are of about the ſame height: but there are many plants in which the piſtil is longer than the ſtamina; and in theſe it is wonderful to obſerve, that the Creator has made the flowers recline, in order that the duſt may the more eaſily fall into the ſtigma, *e g.* in the campanula, cowſlip, &c. This curious phenomenon did not eſcape the poetical eye of Milton, who deſcribes it in the following enlivened imagery:

With cowſlips wan, that hang the penſive head.

But when the fecundation is completed, the flowers riſe again, that the ripe ſeeds may not fall out before they are diſperſed by the winds. In other flowers, on the contrary, the piſtil is ſhorter, and there the flowers preſerve an erect ſituation; nay, when the flowering comes on, they become erect, though before they were drooping, or immerſed under water. Laſtly, whenever the male flowers are placed below the female ones, the leaves are exceedingly ſmall and narrow, that they may not hinder the duſt from flying upwards like ſmoke; as we ſee in the pine, fir, yew, ſea-grape, juniper, cypreſs, &c. And when in one and the ſame ſpecies one plant is male and the other female, and conſequently may be far from one another, there the duſt, without which there is no impregnation, is carried in abundance by the help of the wind from the male to the female; as in the whole diœcious claſs. Again, a more difficult impregnation is compenſated by the longevity of the individuals, and the continuation of life by buds, ſuckers, and roots; ſo that we may obſerve every thing moſt wiſely diſpoſed in this affair. Moreover, we cannot without admiration obſerve, that moſt flowers expand themſelves when the ſun ſhines forth; whereas when clouds, rain, or the evening comes on, they cloſe up, leſt the genital duſt ſhould be coagulated or rendered uſeleſs, ſo that it cannot be conveyed to the ſtigmata. But what is ſtill more remarkable and wonderful, when the fecundation is over, the flowers, neither in rain nor on the approach of night cloſe themſelves up. Hence when rain falls in the flowering time, the huſbandman and gardener foretel a ſcarcity of fruits. To mention only one particular more: The organs of generation, which in the animal kingdom are by nature generally removed from ſight, in the vegetable are expoſed to the eyes of all; and that when their nuptials are celebrated, it is wonderful what delight they afford to the ſpectator by their moſt beautiful colours and delicious odours. At this time bees, flies, and other inſects, ſuck honey out of their nectaries, not to mention the humming bird; and that from their effete duſt the bees gather wax. All the experiments that have hitherto been made ſeem to confirm the hypotheſis above unfolded; although it has lately been controverted by the author of the *Philoſophy of Natural Hiſtory*.

Vid. a treatiſe publiſhed in *Amœn. Acad.* vol. i. intitled *Sponſalia Plantarum.*

As to the diſſemination of ſeeds after they come to maturity, it being abſolutely neceſſary, ſince without it no crop could follow, the Author of nature has wiſely provided for this affair in numberleſs ways. The ſtalks and ſtems favour this purpoſe; for theſe raiſe the fruit above the ground, that the winds, ſhaking them to and fro, may diſperſe far off the ripe ſeeds. Moſt of the pericarpies are ſhut at top, that the ſeeds may not fall before they are ſhaken out by ſtormy winds. Wings are given to many ſeeds, by the help of which they fly far from the mother-plant, and oftentimes ſpread over a whole country. Theſe wings conſiſt either of a down, as in moſt of the compoſite-flowered plants; or of a membrane, as in the birch, alder, aſh, &c. Hence woods, which happen to be conſumed by fire or any other accident, will ſoon be reſtored again by new plants diſſeminated by this means. Many kinds of fruits are endued with a remarkable elaſticity, by the force of which the ripe pericarpies throw the ſeeds to a great diſtance; as the wood-ſorrel, the ſpurge, the phyllanthus, the dittany. Other ſeeds or pericarpies are rough, or provided with hooks; ſo that they are apt to ſtick to animals that paſs by them, and by this means are carried to their holes, where they are both ſown and manured by nature's wonderful care: and therefore the plants of theſe ſeeds grow where others will not; as hounds-tongue, agrimony, &c.

Berries and other pericarpies are by nature allotted for aliment to animals; but with this condition, that while they eat the pulp they ſhall ſow the ſeeds: for when they feed upon it, they either diſperſe them at the ſame time; or, if they ſwallow them, they are returned with intereſt, for they always come out unhurt. It is not therefore ſurpriſing, that, if a field be manured with recent mud or dung not quite rotten, various other plants, injurious to the farmer, ſhould come up along with the grain that is ſowed. Many have believed that barley or rye has been changed into oats, although all ſuch kinds of metamorphoſes are repugnant to the laws of generation; not conſidering, that there is another cauſe of this phenomenon, *viz.* that the ground perhaps has been manured with horſe-dung, in which the ſeeds of oats, coming entire from the

4 horſe,

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horse, lie hid and produce that grain. The missletoe always grows upon other trees, because the thrush that eats the seeds of it, casts them forth with its dung; and as bird-catchers make their bird-lime of this same plant, and daub the branches of trees with it, in order to catch the thrush, the proverb hence took its rise:

> The thrush, when he befouls the bough,
> Sows for himself the seeds of wo.

It is not to be doubted, but that the greatest part of the junipers also, that fill our woods, are sown by thrushes, and other birds, in the same manner; as the berries, being heavy, cannot be dispersed far by the winds. The cross-bill that lives on the fir-cones, and the hawfinch that feeds on the pine-cones, at the same time sow many of their seeds; especially when they carry the cone to a stone, or trunk of a tree, that they may more easily strip it of its scales. Swine likewise, by turning up the earth, and moles by throwing up hillocks, prepare the ground for seeds in the same manner as the ploughman does.

We pass over many other things which might be mentioned concerning the sea, lakes, and rivers, by the help of which oftentimes seeds are conveyed unhurt to distant countries. A variety of other ways in which nature provides for the dissemination of plants, has been pointed out by Linnæus in an *Oration concerning the augmentation of the habitable earth*. As there is something very ingenious and quite new in the treatise here referred to, we shall, for the sake of those who cannot read the original, add a short abstract of it. His design is to show, that there was only one pair of all living things, created at the beginning. According to the account of Moses, says the author, we are sure that this was the case in the human species; and by the same account we are informed that this first pair was placed in Eden, and that Adam gave names to all the animals. In order therefore that Adam might be enabled to do this, it was necessary that all the species of animals should be in paradise; which could not happen unless also all the species of vegetables had been there likewise. This he proves from the nature of their food; particularly in relation to insects, most of which live upon one plant only. Now had the world been formed in its present state, it could not have happened that all the species of animals should have been there. They must have been dispersed over all the globe, as we find they are at present; which he thinks improbable for other reasons which we shall pass over for sake of brevity. To solve all the phenomena, then, he lays down as a principle, That at the beginning all the earth was covered with the sea, unless one island large enough to contain all animals and vegetables. This principle he endeavours to establish by several phenomena, which makes it probable that the earth has been and is still gaining upon the sea, and does not forget to mention fossil shells and plants every where found, which he says cannot be accounted for by the deluge. He then undertakes to show how all vegetables and animals might in this island have a soil and climate proper for each, only by supposing it to be placed under the equator, and crowned with a very high mountain. For it is well known that the same plants are found on the Swiss, the Pyrenean, the Scots Alps, on Olympus, Lebanon, Ida, as on the Lapland and Greenland Alps. And Tournefort found at the bottom of mount Ararat the common plants of Armenia, a little way up those of Italy, higher those which grow about Paris, afterwards the Swedish plants, and lastly on the top the Lapland Alpine plants; and I myself, adds the author, from the plants growing on the Dalecarlian Alps could collect how much lower they were than the Alps of Lapland. He then proceeds to show how from one plant of each species the immense number of individuals now existing might arise. He gives some instances of the surprising fertility of certain plants; *v. g.* the elecampane, one plant of which produced 3000 seeds; of spelt, 2000; of the sun-flower, 4000; of the poppy, 3200; of tobacco, 40,320. But supposing any annual plant producing yearly only two seeds, even of this, after 20 years, there would be 1,048,576 individuals. For they would increase yearly in a duple proportion, *viz.* 2, 4, 8, 16, 32, &c. He then gives some instances of plants brought from America, that are now become common over many parts of Europe. Lastly, he enters upon a detail of the several methods which nature has taken to propagate vegetables, which is extremely curious, but too long to insert in this place.

II. Preservation.

1. The great Author and Parent of all things decreed, that the whole earth should be covered with plants, and that no place should be void, none barren. But since all countries have not the same changes of seasons, and every soil is not equally fit for every plant; he therefore, that no place should be without some, gave to every one of them such a nature, as might be chiefly adapted to the climate: so that some of them can bear an intense cold, others an equal degree of heat; some delight in dry ground, others in moist, &c. Hence the same plants grow only where there are the same seasons of the year, and the same soil.

The Alpine plants live only in high and cold situations; and therefore often on the Alps of Armenia, Switzerland, the Pyreneans, &c. whose tops are equally covered with eternal snows as those of the Lapland Alps, plants of the same kind are found, and it would be in vain to seek for them any where else. It is remarkable, in relation to the Alpine plants, that they blow, and ripen their seeds very early, lest the winter should steal upon them on a sudden, and destroy them.

Our northern plants, although they are extremely rare everywhere else, yet are found in Siberia, and about Hudson's Bay; as the arbutus, bramble, wintergreen, &c.

Plants impatient of cold live within the torrid zones; hence both the Indies, though at such a distance from one another, have plants in common. The Cape of Good Hope, we know not from what cause, produces plants peculiar to itself; as all the mesembryanthema, and almost all the species of aloes. Grasses, the most common of all plants, can bear almost any temperature of air: in which the good providence of the Creator particularly appears; for all over the globe, they above all plants are necessary for the nourishment of cattle; and the same thing is seen in relation to our most common grains.

Thus neither the scorching sun, nor the pinching cold, hinders any country from having its vegetables. Nor

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Nor is there any foil which does not bring forth many kinds of plants. The pond-weeds, the water-lily, lobelia, inhabit the waters. The fluviales, fuci, confervæ, cover the bottoms of rivers, and sea. The fphagna * fill the marfhes. The brya † clothe the plains. The drieft woods, and places fcarce ever illuminated by the rays of the fun, are adorned with the hypna. Nay, ftones and the trunks of trees are not excepted, for thefe are covered with various kinds of liverwort.

* A kind of mofs.

† Another kind of mofs.

The defart and moft fandy places have their peculiar trees and plants; and as rivers or brooks are very feldom found there, we cannot without wonder obferve that many of them diftil water, and by that means afford the greateft comfort both to man and beaft that travel there. Thus the tillandfia ‡, which is a parafitical plant, and grows on the tops of trees in the defarts of America, has its leaves turned at the bafe into the fhape of a pitcher, with the extremity expanded; in thefe the rain is collected, and preferved for thirfty men, birds, and beafts.

‡ A kind of miffletoe.

The water-tree in Ceylon produces cylindrical bladders, covered with a lid; into thefe is fecreted a moft pure and refrefhing water, having the tafte of nectar. There is a kind of cuckow-pint in New France, that if you break a branch of it will afford you a pint of excellent water. How wife, how beautiful, is the agreement between the plants of every country, and its inhabitants, and other circumftances!

2. Plants oftentimes by their very ftructure contribute remarkably both to their own prefervation and that of others. But the wifdom of the Creator appears no where more than in the manner of the growth of trees. For as their roots defcend deeper than thofe of other plants, provifion is thereby made, that they fhall not rob them too much of nourifhment; and what is ftill more, a ftem not above a fpan in diameter often fhoots up its branches very high; thefe bear perhaps many thoufand buds, each of which is a plant, with its leaves, flowers, and ftipulæ. Now if all thefe grew upon the plain, they would take up a thoufand times as much fpace as the tree does; and in this cafe there would fcarcely be room in all the earth for fo many plants as at prefent the trees alone afford. Befides, plants that fhoot up in this way are more eafily preferved from cattle by a natural defence; and farther, their leaves falling in autumn cover the plants growing about againft the rigour of the winter; and in the fummer they afford a pleafing fhade, not only to animals, but to plants, againft the intenfe heat of the fun. We may add, that trees, like all other vegetables, imbibe the water from the earth; which water does not circulate again to the root, as the ancients imagined, but being difperfed, like fmall rain, by the tranfpiration of the leaves, moiftens the plants that grow around. Again, many trees bear flefhy fruits of the berry or apple kind, which, being fecure from the attack of cattle, grow ripe for the ufe of man and other animals, while their feeds are difperfed up and down after digeftion. Laftly, the particular ftructure of trees contributes very much to the propagation of infects; for thefe chiefly lay their eggs upon the leaves, where they are fecure from the reach of cattle.

Ever-green trees and fhrubs in the northern parts are chiefly found in the moft barren woods, that they may be a fhelter to animals in the winter. They lofe their leaves only every third year, as their feeds are fufficiently guarded by the moffes, and do not want any other covering. The palms in the hot countries perpetually keep their leaves, for there the feeds ftand in no need of any fhelter whatever.

Many plants and fhrubs are armed with thorns, *e. g.* the buckthorn, floe, carduus, cotton-thiftle, &c. that they may keep off the animals which otherwife would deftroy their fruit. Thefe at the fame time cover many other plants, efpecially of the annual kind, under their branches. Nay, it has frequently been obferved upon commons where furze grows, that wherever there was a bufh left untouched for years by the commoners, fome tree has fprung up, being fecured by the prickles of that fhrub from the bite of cattle. So that while the adjacent grounds are robbed of all plants by the voracity of animals, fome may be preferved to ripen flowers and fruit, and ftock the parts about with feeds, which otherwife would be quite extirpated.

All herbs cover the ground with their leaves, and by their fhade hinder it from being totally deprived of that moifture which is neceffary to their nourifhment. They are moreover an ornament to the earth, efpecially as leaves have a more agreeable verdure on the upper than the under fide.

The moffes which adorn the moft barren places, at the fame time, preferve the leffer plants when they begin to fhoot, from cold and drought; as we find by experience in our gardens, that plants are preferved in the fame way. They alfo hinder the fermenting earth from forcing the roots of plants upwards in the fpring; as we fee happen annually to trunks of trees, and other things put into the ground. Hence very few moffes grow in the warmer climates, as not being fo neceffary to that end in thofe places.

The Englifh fea mat-weed, or marran, will bear no foil but pure fand, which nature has allotted to it. Sand, the produce of the fea, is blown by winds oftentimes to very remote parts, and deluges, as it were, woods and fields. But where this grafs grows, it frequently fixes the fand, gathers it into hillocks, and thrives fo much, that by means of this alone at laft an entire hill of fand is raifed. Thus the fand is kept in bounds, other plants are preferved free from it, the ground is increafed, and the fea is repelled by this wonderful difpofition of nature. This feems to be the fame plant which is called in Scotland *bent*, and is particularly ufeful for the purpofe above mentioned, and only grows among fand along the fea-coaft.

How folicitous nature is about the prefervation of graffes is abundantly evident from hence, that the more the leaves of the perennial graffes are eat, the more they creep by the roots, and fend forth offsets. For the Author of nature intended that vegetables of this kind, which have very flender and erect leaves, fhould be copious, and very thick fet, covering the ground like a carpet; and thus afford food fufficient for fo vaft a quantity of grazing animals. But what chiefly increafes our wonder is, that although the graffes are the principal food of fuch animals, yet they are forbid as it were to touch the flower and feed-bearing ftems, that fo the feeds may ripen and be fown.

The caterpillar or grub of the moth, although it feeds upon graffes, to the great deftruction of them in

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in meadows, yet it ſeems to be formed in order to keep a due proportion between theſe and other plants; for graſſes, when left to grow freely, increaſe to that degree, that they exclude all other plants; which would conſequently be extirpated, unleſs this inſect ſometimes prepared a place for them. Hence always more ſpecies of plants appear in thoſe places where this caterpillar has laid waſte the paſtures the preceding year than at any other time.

III. Destruction.

Daily experience teaches us, that all plants, as well as all other created things, muſt ſubmit to death.

They ſpring up, they grow, they flouriſh, they ripen their fruit, they wither, and at laſt, having finiſhed their courſe, they die, and return to the duſt again, from whence they firſt took their riſe. Thus all black mould, which every where covers the earth, for the greateſt part is owing to dead vegetables. For all roots deſcend into the ſand by their branches, and after a plant has loſt its ſtem the root remains; but this too rots at laſt, and changes into mould. By this means this kind of earth is mixed with ſand, by the contrivance of nature, nearly in the ſame way as dung thrown upon fields is wrought into the earth by the induſtry of the huſbandman. The earth thus prepared offers again to plants from its boſom what it has received from them. For when ſeeds are committed to the earth, they draw to themſelves, accommodate to their nature, and turn into plants, the more ſubtile parts of this mould by the co-operation of the ſun, air, and rains; ſo that the talleſt tree is, properly ſpeaking, nothing but mould wonderfully compounded with air and water, and modified by a virtue communicated to a ſmall ſeed by the Creator. From theſe plants, when they die, juſt the ſame kind of mould is formed as gave birth to them originally; whence fertility remains continually uninterrupted. Whereas the earth could not make good its annual conſumption, unleſs it were conſtantly recruited by new ſupplies.

The cruſtaceous liverworts are the firſt foundation of vegetation; and therefore are plants of the utmoſt conſequence in the œconomy of nature, though ſo deſpiſed by us. When rocks firſt emerge out of the ſea, they are ſo poliſhed by the force of the waves, that ſcarce any herb can find a fixed habitation upon them; as we may obſerve every where near the ſea. But the very minute cruſtaceous liverworts begin ſoon to cover theſe dry rocks, although they have no other nouriſhment but that ſmall quantity of mould and imperceptible particles which the rain and air bring thither. Theſe liverworts dying at laſt turn into a very fine earth; on this earth the imbricated liverworts find a bed to ſtrike their roots in. Theſe alſo die after a time, and turn to mould; and then the various kinds of moſſes, *e. g.* the hypna, the brya, polytricha, find a proper place and nouriſhment. Laſtly, theſe dying in their turn, and rotting, afford ſuch plenty of new-formed mould, that herbs and ſhrubs eaſily root and live upon it.

That trees, when they are dry or are cut down, may not remain uſeleſs to the world, and lie as it were melancholy ſpectacles, nature haſtens on their deſtruction in a ſingular way: firſt, the liverworts begin to ſtrike root in them; afterwards the moiſture is drawn out of them; whence putrefaction follows. Then the muſhroom kinds find a fit place for nouriſhment on them, and corrupt them ſtill more. The beetle called *dermeſtes* next makes himſelf a way between the bark and the wood. The muſk-beetle, the copper talc-beetle, and the caterpillar or coſſus 812 (*S. N.*) bores an infinite number of holes through the trunk. Laſtly, the woodpeckers come, and, while they are ſeeking for inſects, wear away the tree already corrupted; till the whole paſſes into earth. Such induſtry does nature uſe to deſtroy the trunk of a tree! Nay, trees immerſed in water would ſcarcely ever be deſtroyed, were it not for the worm that eats ſhips, which performs this work; as the ſailor knows by ſad experience.

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Thiſtles, as the moſt uſeful of plants, are armed and guarded by nature herſelf. Suppoſe there were a heap of clay, on which for many years no plant has ſprung up; let the ſeeds of the thiſtle blow there, and grow, the thiſtles by their leaves attract the moiſture out of the air, ſend it into the clay by means of their roots, will thrive themſelves, and afford a ſhade. Let now other plants come hither, and they will ſoon cover the ground.

All ſucculent plants make ground fine, of a good quality, and in great plenty; as ſedum, craſſula, aloe, algæ. But dry plants make it more barren, as heath, pines, moſs; and therefore nature has placed the ſucculent plants on rocks and the drieſt hills.

Sect. IV. *The Animal Kingdom.*

I. Propagation.

1. The generation of animals holds the firſt place among all things that raiſe our admiration when we conſider the works of the Creator; and chiefly that appointment by which he has regulated the conception of the fœtus, and its excluſion, that it ſhould be adapted to the diſpoſition and way of living of each animal, is moſt worthy of our attention.

We find no ſpecies of animals exempt from the ſtings of love, which is put into them to the end that the Creator's mandate may be executed, *Increaſe and multiply*: and that thus the egg, in which is contained the rudiment of the fœtus, may be fecundated; for without fecundation all eggs are unfit to produce an offspring.

Foxes and wolves, ſtruck with theſe ſtings, every where howl in the woods; crowds of dogs follow the female; bulls ſhow a terrible countenance, and very different from that of oxen. Stags every year have new horns, which they loſe after rutting time. Birds look more beautiful than ordinary, and warble all day long through laſciviouſneſs. Thus ſmall birds labour to outſing one another, and cocks to outcrow. Peacocks ſpread forth again their gay and glorious trains. Fiſhes gather together, and exult in the water; and graſhoppers chirp, and pipe, as it were, amongſt the herbs. The ants gather again into colonies, and repair to their citadels. We paſs over many other particulars which this ſubject affords, to avoid prolixity.

2. The fecundated egg requires a certain and proportionate degree of heat for the expanſion of the

ftamina of the embryo. That this may be obtained, nature operates in different manners; and therefore we find in different claffes of animals a different way of excluding the fœtus.

The females of quadrupeds have an uterus, contrived for eafy geftation, temperate and cherifhing warmth, and proper nourifhment of the fœtus, as moft of them live upon the earth, and are there fed.

Birds, in order to get fubfiftence, and for other reafons, are under a neceffity of fhifting place; and that not upon their feet, but wings. Geftation therefore would be burthenfome to them. For this reafon they lay eggs, covered with a hard fhell. Thefe they fit upon by a natural inftinct, and cherifh till the young one comes forth.

The oftrich and caffowary are almoft the only birds that do not obferve this law; thefe commit their eggs to the fand, where the intenfe heat of the fun excludes the fœtus.

Fifhes inhabit cold waters, and moft of them have cold blood; whence it happens that they have not heat fufficient to produce the fœtus. The all-wife Creator therefore has ordained, that moft of them fhould lay their eggs near the fhore; where, by means of the folar rays, the water is warmer, and alfo fitter for that purpofe; and alfo becaufe water-infects abound more there, which afford the young fry nourifhment.

Salmon, when they are about to lay their eggs, are led by inftinct to go up the ftream, where the water is frefh and more pure.

The butterfly-fifh is an exception, for that brings forth its fœtus alive.

The fifh of the ocean, which cannot reach the fhores by reafon of the diftance, are alfo exempt from this law. The Author of nature has given to this kind eggs that fwim; fo that they are hatched amidft the fwimming fucus, called *fargazo* *.

Flor. l. 389. The cetaceous fifh have warm blood; and therefore they bring forth their young alive, and fuckle them with their teats.

Many amphibious animals bring forth live fœtufes, as the viper and the toad, &c. But the fpecies that lay eggs, lay them in places where the heat of the fun fupplies the warmth of the parent.

Thus the reft of the frog kind, and the lizard kind, lay their eggs in warm waters; the common fnake, in dunghills, and fuch like warm places; and give them up to nature, as a provident nurfe, to take care of them. The crocodile and fea-tortoifes go afhore to lay their eggs under the fand, where the heat of the fun hatches them.

Moft of the infect kind neither bear young nor hatch eggs: yet their tribes are the moft numerous of all living creatures; infomuch, that if the bulk of their bodies were proportionate to their quantity, they would fcarce leave room for any other kinds of animals. Let us fee therefore with what wifdom the Creator has managed about the propagation of thefe minute creatures. The females by natural inftinct meet and copulate with the males; and afterwards lay their eggs: but not indifcriminately in every place. For they all know how to choofe fuch places as may fupply their offspring in its tender age with nourifhment, and other things neceffary to fatisfy their natural wants: for the mother, foon after fhe has laid her eggs, dies; and were fhe to live, fhe would not have it in her power to take care of her young.

Butterflies, moths, fome beetles, weevils, bugs, cuckow-fpit infects, gall-infects, tree-bugs, &c. lay their eggs on the leaves of plants, and every different tribe choofes its own fpecies of plant. Nay, there is fcarce any plant which does not afford nourifhment to fome infect; and ftill more, there is fcarcely any part of a plant which is not preferred by fome of them. Thus one infect feeds upon the flower; another upon the trunk; another upon the root; and another upon the leaves. But we cannot help wondering particularly, when we fee how the leaves of fome trees and plants, after eggs have been let into them, grow into galls; and form dwellings, as it were, for the young ones. Thus when the gall-infect has fixed her eggs in the leaves of an oak, the wound of the leaf fwells, and a knob like an apple arifes, which includes and nourifhes the embryo.

When the tree-bug has depofited its eggs in the boughs of the fir-tree, excrefcences arife fhaped like pearls. When another fpecies of the tree-bug has depofited its eggs in the moufe-ear chickweed or the fpeedwell, the leaves contract in a wonderful manner into the fhape of a head. The water-fpider excludes eggs either on the extremities of the juniper, which from thence forms a lodging, that looks like the arrow-headed grafs; or on the leaves of the poplar, from whence a red globe is produced. The tree-loufe lays its eggs on the leaves of the black poplar, which turn into a kind of inflated bag; and fo in other inftances. Nor is it upon plants only that infects live and lay their eggs. The gnats commit theirs to ftagnating waters. The water-infect called *monoculus* often increafes fo immenfely on pools, that the red legions of them have the appearance of blood. Others lay their eggs in other places: *e. g.* the beetle, in dunghills; the dermeftes, in fkins; the flefh fly, in putrified flefh; the cheefe-maggot, in the cracks of cheefe, from whence the caterpillars iffuing forth, oftentimes confume the whole cheefe, and deceive many people, who fancy the worms are produced from the particles of the cheefe itfelf, by a generation called *equivocal*, which is extremely abfurd. Others exclude their eggs upon certain animals. The mill-beetle lays its eggs between the fcales of fifhes; the fpecies of gad-fly, on the back of cattle; the fpecies 1022 (*S. N.*) on the back of the rein-deer; the fpecies 1026, in the nofes of fheep. The fpecies 1028 lodges during the winter in the inteftinal tube, or the throat of horfes, nor can it be driven out till the fummer comes on. Nay, infects themfelves are often furrounded with the eggs of other infects, infomuch that there is fcarcely an animal to be found which does not afford food for other animals. Almoft all the eggs of infects, when laid, are ordained to undergo, by a wonderful law of nature, various metamorphofes, *e. g.* the egg of the butterfly, being laid in the cabbage, firft of all becomes a caterpillar, that feeds on the herb, crawls, and has 16 feet. This afterwards changes into a nymph, that has no feet, is fmooth, and eats nothing; and laftly, this burfts into a butterfly that flies, has variety of colours, is hairy, and lives upon honey. What can be more worthy of admiration than that one and the fame animal fhould appear on the ftage of life under fo many characters, as

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as if it were three diftinct animals. Linnæus (*Amœn. Academ.* tom. ii.) in a treatife on the wonders relating to infects, fays, "As furprifing as thefe transformations may feem, yet much the fame happens when a chicken is hatched; the only difference is, that this chicken breaks all three coats at once, the butterfly one after another."

The laws of generation of worms are ftill very obfcure; as we find they are fometimes produced by eggs, fometimes by offsets, juft in the fame manner as happens to trees. It has been obferved with the greateft admiration, that the polypus or hydra (*S. N.* 221.) lets down fhoots and live branches, by which it is multiplied. Nay more, if it be cut into many parts, each fegment, put into the water, grows into a perfect animal; fo that the parts which were torn off are reftored, and form a complete and perfect animal like that from which it was torn.

3. The multiplication of animals is not tied down to the fame rules in all; for fome have a remarkable power of propagating, others are confined within narrow limits in this refpect. Yet in general we find, that nature obferves this order, that the leaft animals, and thofe which are ufeful and ferve for nourifhment to the greateft number of other animals, are endued with a greater power of propagating than others.

Mites, and many other infects, will multiply to a thoufand within the compafs of a very few days; while the elephant fcarcely produces one young in two years.

The hawk-kind generally lay not above two eggs, at moft four; while the poultry kind produce from 50 to 100.

The diver, or loon, which is eaten by few animals, lays alfo two eggs; but the duck kind, the moorgame, partridges, &c. and fmall birds, lay a very large number.

If you fuppofe two pigeons to hatch nine times a-year, they may produce in four years 14,760 young. They are endued with this remarkable fertility, that they may ferve for food, not only for man, but for hawks and other birds of prey. Nature has made harmlefs and efculent animals fruitful. She has forbid the bird kind to fall fhort of the number of eggs allotted to each fpecies: and therefore, if the eggs which they intend to fit upon be taken away a certain number of times, they prefently lay others in their room, as may be feen in the fwallow, duck, and fmall birds.

II. Preservation.

1. Prefervation follows generation: this appears chiefly in the tender age, while the young are unable to provide for their own fupport. For then their parents, though otherwife ever fo fierce in their difpofition, are affected with a wonderful tendernefs or fenfe of love towards their progeny, and fpare no pains to provide for, guard, and preferve them; and that not by an imaginary law, but one given by the Lord of nature himfelf.

Quadrupeds give fuck to their tender young, and fupport them by a liquor perfectly eafy of digeftion, till nature enables them to digeft what is more folid. Nay, their love toward them is fo great, that they endeavour to repel with the utmoft force every thing which threatens danger or deftruction to them. The ewe, which brings forth two lambs at a time, will not admit one to her teats unlefs the other be prefent and fuck alfo; left one fhould famifh, while the other grows fat.

Birds build their nefts in the moft artificial manner, and line them as foft as poffible, for fear the eggs fhould get any damage. Nor do they build promifcuoufly in any place, but there only where they may quietly lie concealed and be fafe from the attacks of their enemies.

The hanging bird makes its neft of the fibres of withered plants, and the down of the poplar feeds, and fixes it upon the bough of fome tree hanging over the water, that it may be out of reach.

The diver places its fwimming neft upon the water itfelf, amongft the rufhes. We defignedly pafs over many inftances of the like kind.

Again, birds fit on their eggs with fo much patience, that many of them choofe to perifh with hunger, rather than expofe the eggs to danger by going to feek for food.

The male rooks and crows, at the time of incubation, bring food to the females.

Pigeons, fmall birds, and other birds which pair, fit by turns; but where polygamy prevails, the males fcarcely take any care of the young.

Moft of the duck kind pluck off their feathers in great quantity, and cover their eggs with them, left they fhould be damaged by the cold when they quit their nefts for the fake of food; and when the young are hatched, who knows not how folicitous they are in providing for them till they are able to fly and fhift for themfelves?

Young pigeons would not be able to make ufe of hard feeds for nourifhment, unlefs the parents were to prepare them in their crops, and thence feed them.

The owl called the *eagle-owl* makes its neft on the higheft precipices of mountains, and in the warmeft fpot, facing the fun; that the dead bodies brought there may by the heat melt into a foft pulp, and become fit nourifhment for the young.

As an exception indeed to this foftering care of animals, may be mentioned the cuckow, which lays its eggs in the neft of other fmall birds, generally the wag-tail, yellow hammer, or white-throat, and leaves the incubation or prefervation of the young to them. This cuftom of the cuckow is fo extraordinary, and out of the common courfe of nature, that it would not be credible were it not for the teftimony of the moft knowing and curious natural-hiftorians, fuch as Ray, Willoughby, Gefner, Aldrovandus, Ariftotle, &c. But this feeming want of inftinct is accounted for from the ftructure and fituation of its ftomach, which difqualifies it for incubation †; and its inftinctive care is ftill confpicuous in providing a proper, though a foreign, nidus for its eggs.

† See the article *Cuculus*.

Amphibious animals, fifhes, and infects, which cannot come under the care of their parents, yet owe this to them, that they are put in places where they eafily find nourifhment.

2. As foon as animals come to maturity, and want no longer the care of their parents, they attend with the utmoft labour and induftry, according to the law and œconomy appointed for every fpecies, to the prefervation

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servation of their lives. But that so great a number of them, which occur every-where, may be supported, and a certain and fixed order may be kept up amongst them, behold the wonderful disposition of the Creator, in assigning to each species certain kinds of food, and in putting limits to their appetites. So that some live on particular species of plants, which particular regions and soils only produce: some on particular animalcula; others on carcases; and some even on mud and dung. For this reason, Providence has ordained that some should swim in certain regions of the watery element; others should fly: some should inhabit the torrid, the frigid, or the temperate zones; and others should frequent desarts, mountains, woods, pools, or meadows, according as the food proper to their nature is found in sufficient quantity. By this means there is no terrestrial tract, no sea, no river, no country, but what contains and nourishes various kinds of animals. Hence also an animal of one kind cannot rob those of another kind of its aliment; which, if it happened, would endanger their lives or health: and thus the world at all times affords nourishment to so many and so large inhabitants, at the same time that nothing which it produces is useless or superfluous.

It will not be here amiss to produce some instances by which it will appear how providentially the Creator has furnished every animal with such cloathing as is proper for the country where they live, and also how excellently the structure of their bodies is adapted to their particular way of life; so that they seem to be destined solely to the places where they are found

Monkeys, elephants, and rhinoceroses, feed upon vegetables that grow in hot countries, and therefore therein they have their allotted places. When the sun darts forth its most fervid rays, these animals are of such a nature and disposition, that it does them no manner of hurt; nay, with the rest of the inhabitants of those parts, they go naked; whereas, were they covered with hairy skins, they must perish with heat.

On the contrary, the place of rein-deer is fixed in the coldest part of Lapland, because their chief food is the liverwort, which grows no-where so abundantly as there; and where, as the cold is most intense, the rein-deer are clothed, like the other northern animals, with skins filled with the densest hair, by the help of which they easily defy the keenness of the winter. In like manner the rough-legged partridge passes its life in the very Lapland Alps, feeding upon the seeds of the dwarf birch; and, that they may run up and down safely amidst the snow, their feet are feathered.

The camel frequents the sandy and burning desarts, in order to get the barren camel's-hay. How wisely has the Creator contrived for him! he is obliged to go through the desarts, where oftentimes no water is found for many miles about. All other animals would perish with thirst in such a journey: but the camel can undergo it without suffering; for his belly is full of cells, where he reserves water for many days. It is reported by travellers, that the Arabians, when in travelling they want water, are forced to kill their camels, and take water out of their bellies that is perfectly good to drink, and not at all corrupted.

The pelican likewise lives in desart and dry places; and is obliged to build her nest far from the sea, in order to procure a greater share of heat to her eggs. She is therefore forced to bring water from afar for herself and her young; for which reason Providence has furnished her with an instrument most adapted to this purpose: She has a very large bag under her throat, which she fills with a quantity of water sufficient for many days; and this she pours into the nest, to refresh her young, and teach them to swim.

The wild beasts, lions, and tygers, come to this nest to quench their thirst, but do no hurt to the young.

Oxen delight in low grounds, because there the food most palatable to them grows.

Sheep prefer naked hills, where they find a particular kind of grass called the *festuca*, which they love above all things.

Goats climb up the precipices of mountains, that they may browse on the tender shrubs; and in order to fit them for it, they have feet made for jumping.

Horses chiefly resort to woods, and feed upon leafy plants.

Nay, so various is the appetite of animals, that there is scarcely any plant which is not chosen by some, and left untouched by others. The horse gives up the water-hemlock to the goat. The cow gives up the long-leaved water-hemlock to the sheep. The goat gives up the monks-hood to the horse, &c.; for that which certain animals grow fat upon, others abhor as poison. Hence no plant is absolutely poisonous, but only respectively. Thus the spurge, that is noxious to man, is a most wholesome nourishment to the caterpillar. That animals may not destroy themselves for want of knowing this law, each of them is guarded by such a delicacy of taste and smell, that they can easily distinguish what is pernicious from what is wholesome; and when it happens that different animals live upon the same plants, still one kind always leaves something for the other, as the mouths of all are not equally adapted to lay hold of the grass; by which means there is sufficient food for all. To this may be referred an œconomical experiment well known to the Dutch, that when eight cows have been in a pasture, and can no longer get nourishment, two horses will do very well there for some days; and when nothing is left for the horses, four sheep will live upon it.

Swine get provision by turning up the earth; for there they find the succulent roots, which to them are very delicious.

The leaves and fruits of trees are intended as food for some animals, as the sloth, the squirrel; and these last have feet given them fit for climbing.

Besides myriads of fishes, the castor, the sea-calf, and others, inhabit the water, that they may there be fed; and their hinder-feet are fit for swimming, and perfectly adapted to their manner of life.

The whole order of the goose-kind, as ducks, merganser, &c. pass their lives in water, as feeding upon water-insects, fishes, and their eggs. Who does not see, that attends ever so little, how exactly the wonderful formation of their beaks, their necks, their feet, and their feathers, suit their kind of life; which obser-

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obſervation ought to be extended to all other birds.

The way of living of the ſea-ſwallow deſerves to be particularly taken notice of; for as he cannot ſo commodiouſly plunge into the water, and catch fiſh, as other aquatic birds, the Creator has appointed the ſea-gull to be his caterer, in the following manner: When this laſt is purſued by the former, he is forced to throw up part of his prey, which the other catches; but in the autumn, when the fiſhes hide themſelves in deep places, the merganſer ſupplies the gull with food, as being able to plunge deeper into the ſea.

The chief granary of ſmall birds is the knot graſs, that bears heavy ſeeds, like thoſe of the black bindweed. It is a very common plant, not eaſily deſtroyed, either by the road-ſide by trampling upon it, or anywhere elſe; and is extremely plentiful after harveſt in fields, to which it gives a reddiſh hue by its numerous ſeeds. Theſe fall upon the ground, and are gathered all the year round by the ſmall birds. To which we may add, that many ſmall birds feed upon the ſeeds of plantain, particularly linnets. It is generally known that the goldfinch lives upon the ſeed of thiſtles, from which he has its name in Latin and French. Thus bountiful nature feeds the *fowls of the air*.

The Creator has taken no leſs care of ſome amphibious animals, as the ſnake and frog kind; which, as they have neither wings to fly, nor feet to run ſwiftly and commodiouſly, would ſcarcely have any means of taking their prey, were it not that ſome animals run, as it were, of their own accord, into their mouths. When the rattle-ſnake, a native of America, with open jaws fixes his eyes upon a bird, fly, or ſquirrel, ſitting on a tree, they fly down his throat, being rendered ſtupid, and giving themſelves up as deſtitute of all refuge. How dreadful this ſerpent is to other animals will appear by an account we have in a treatiſe entitled, *Radix Senega*. Where the author (*Amœn. Academ* tom. 2.) ſays, one of theſe terrible ſerpents got clandeſtinely into the houſe of governor Blake at Carolina; where it would have long lain concealed, had it not been that all the domeſtic animals, as dogs, hogs, turkeys, and fowls, admoniſhed the family by their unuſual cries, equally ſhowing their horror and conſternation, their hair, briſtles, and creſts, ſtanding up on end. On the other hand, we cannot but adore the Creator's great goodneſs towards man, when we conſider the rattle which terminates this ſerpent's tail: for by means of that we have an opportunity of guarding againſt this dreadful enemy; the ſound warning us to fly; which if we were not to do, and we ſhould be wounded by him, the whole body would be turned into a putrid corruption in ſix hours, nay ſometimes in half an hour.

The limits of this article will not permit us to produce more examples of this kind. But whoever will be at the pains to take ever ſo ſlight a view of the wonderful works of the Author of nature, will readily ſee how wiſely the plan, order, and fitneſs of things with divine ends, are diſpoſed.

3. We cannot without the utmoſt admiration behold how providentially the Creator has acted as to the preſervation of thoſe animals which, at a certain time of the year, are by the rigour of the ſeaſon excluded from the neceſſaries of life. Thus the bear in the autumn creeps into the moſs which he has gathered, and there lies all winter; ſubſiſting upon no other nouriſhment but his fat, collected during the ſummer in the cellulous membrane, and which without doubt, during his faſt, circulates through his veſſels, and ſupplies the place of food; to which perhaps is added that fat juice which he ſucks out of the bottom of his feet.

The hedge-hog, badger, and mole, in the ſame manner fill their winter-quarters with vegetables, and ſleep during the froſts. The bat ſeems cold and quite dead all the winter. Moſt of the amphibious animals get into dens, or to the bottom of lakes and pools.

In the autumn, as the cold approaches, and inſects diſappear, ſwallows migrate into other climes in ſearch of food and a temperature of air more friendly to their conſtitution: though the latter hatches, or thoſe young birds which are incapable of diſtant flights, ſeek for an aſylum againſt the violence of the cold in the bottom of lakes amongſt the reeds and ruſhes; from whence, by the wonderful appointment of nature, they come forth again. See the article Hirundo. The periſtaltic motion of the bowels ceaſes in all theſe animals while they are obliged to faſt; whence the appetite is diminiſhed, and ſo they ſuffer the leſs from hunger. To this head may be referred the obſervation of the celebrated Liſter concerning thoſe animals, That their blood, when let into a veſſel, does not coagulate, as that of all other animals; and ſo is no leſs fit for circulation than before.

The moor-fowls work themſelves out walks under the very ſnow. They moult in the ſummer; ſo that about the month of Auguſt they cannot fly, and are therefore obliged to run into the woods; but then the moor-berries and bilberries are ripe, from whence they are abundantly ſupplied with food. Whereas the young do not moult the firſt ſummer; and therefore, though they cannot run ſo well, are able to eſcape danger by flight.

The reſt of the birds who feed upon inſects migrate every year to foreign regions, in order to ſeek for food in a milder climate; while all the northern parts, where they live well in the ſummer, are covered with ſnow.

By theſe migrations, birds alſo become uſeful to many different countries, and are diſtributed overalmoſt all the globe. And it muſt excite our admiration that all of them exactly obſerve the times of coming and going, and that they do not miſtake their way.

Inſects in the winter generally lie hid within their caſes, and are nouriſhed by the ſurrounding liquor like the fœtus of other animals; from whence, at the approach of ſpring, they awake, and fly forth, to the aſtoniſhment of every one.

However, all animals which lie hid in winter do not obſerve theſe laws of faſting. Some provide ſtorehouſes in ſummer and autumn, from which they take what is neceſſary; as mice, jays, ſquirrels, bees.

III. Destruction.

1. We have obſerved above, that all animals do not live upon vegetables, but that there are ſome which feed

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feed upon certain animalcula. Nay, there are ſome which ſubſiſt only by rapine, and daily deſtroy numbers of the peaceable kind.

Theſe animals are deſtroyed, but in ſuch a manner that the weaker generally are infeſted by the ſtronger in a continued ſeries. Thus the tree-louſe lives upon plants. The fly called *muſca aphidivora* lives upon the tree-louſe; the hornet and waſp-fly, upon the muſca aphidivora; the dragon-fly, upon the hornet and waſp-fly; the ſpider, on the dragon-fly; the ſmall birds on the ſpider; and laſtly, the hawk kind on the ſmall birds

In like manner, the monoculus delights in putrid waters, the gnat eats the monoculus, the frog eats the gnat, the pike eats the frog, the ſea-calf eats the pike.

The bat and goat-ſucker make their excurſions only at night, that they may catch the moths, which at that time fly about in vaſt quantities.

The woodpecker pulls out the inſects which lie hid in the trunks of trees.

The ſwallow purſues thoſe which fly about in the open air.

The mole purſues worms. The large fiſhes devour the ſmall. Nay, we ſcarcely know an animal which has not ſome enemy to contend with.

Amongſt quadrupeds wild beaſts are moſt remarkably pernicious and dangerous to others, as the hawk kind among birds. But that they may not, by too atrocious a butchery, deſtroy a whole ſpecies, even theſe are circumſcribed within certain bounds. Firſt, as to the moſt fierce of all, it deſerves to be noted how few they are in proportion to other animals. Secondly, the number of them is not equal in all countries. Thus France and England breed no wolves, and the northern countries no tigers or lions. Thirdly, theſe fierce animals ſometimes fall upon and deſtroy one another. Thus the wolf devours the fox. The dog infeſts both the wolf and fox; nay, wolves in a body will ſometimes venture to ſurround a bear. The tiger often kills its own male whelps. Dogs are ſometimes ſeized with madneſs, and deſtroy their fellows, or with the mange deſtroy themſelves.

Laſtly, wild beaſts ſeldom arrive at ſo great an age as animals which live on vegetables. For they are ſubject, from their alkaline diet, to various diſeaſes, which bring them ſooner to an end.

But although all animals are infeſted by their peculiar enemies, yet they are often able to elude their violence by ſtratagems and force. Thus the hare often confounds the dog by her windings.

When the bear attacks ſheep and cattle, theſe draw up together for mutual defence. Horſes join heads together, and fight with their heels. Oxen join tails, and fight with their horns.

Swine get together in herds, and boldly oppoſe themſelves to any attack, ſo that they are not eaſily overcome; and it is worth while to obſerve, that all of them place their young, as leſs able to defend themſelves, in the middle, that they may remain ſafe during the battle.

Birds, by their different ways of flying, oftentimes eſcape the hawk. If the pigeon had the ſame way of flying as the hawk, ſhe would hardly ever eſcape his claws.

It deſerves alſo to be remarked, how much ſome animals conſult their ſafety by night. When horſes ſleep in woods, one by turn remains awake, and, as it were, keeps watch. When monkeys in Braſil ſleep upon trees, one of them keeps awake, in order to give the ſign when the tiger creeps towards them; and in caſe the guard ſhould be caught aſleep, the reſt tear him to pieces. Hence rapacious animals are not always ſucceſsful in their hunting, and are often obliged to labour for a whole day to no purpoſe. For this reaſon the Creator has given them ſuch a nature, that they can bear faſting a long time. Thus the lion lurks in his den many days without famiſhing; and the wolf, when he has once well ſatisfied his hunger, can faſt many weeks without any difficulty.

If we conſider the end for which it pleaſed the Supreme Being to conſtitute ſuch an order of nature, that ſome animals ſhould be, as it were, created only to be miſerably butchered by others, it ſeems that his Providence not only aimed at ſuſtaining, but alſo keeping a juſt proportion amongſt all the ſpecies; and ſo prevent any one of them from increaſing too much, to the detriment of men and other animals. For if it be true, as it moſt aſſuredly is, that the ſurface of the earth can ſupport only a certain number of inhabitants, they muſt all periſh if the ſame number were doubled or trebled.

There are ſome viviparous flies which bring forth 2000 young. Theſe in a little time would fill the air, and like clouds intercept the rays of the ſun, unleſs they were devoured by birds, ſpiders, and many other animals.

Storks and cranes free Egypt from frogs, which, after the inundation of the Nile, cover the whole country. Falcons clear Paleſtine of mice. Bellonius on this ſubject ſays as follows: "The ſtorks come to Egypt in ſuch abundance, that the fields and meadows are white with them. Yet the Egyptians are not diſpleaſed with this ſight; as frogs are generated in ſuch numbers there, that did not the ſtorks devour them, they would over-run every thing. Beſides, they alſo catch and eat ſerpents. Between Belba and Gaza, the fields of Paleſtine are often deſart on account of the abundance of mice and rats; and were they not deſtroyed by the falcons that come here by inſtinct, the inhabitants could have no harveſt."

The white fox is of equal advantage in the Lapland Alps; as he deſtroys the Norway rats, which are generated there in great abundance, and thus hinders them from increaſing too much in proportion, which would be the deſtruction of vegetables.

It is ſufficient for us, that nothing is made by Providence in vain; and that whatever is made, is made with ſupreme wiſdom For it does not become us to pry too boldly into all the deſigns of God. Let us not imagine, when theſe rapacious animals ſometimes do us miſchief, that the Creator planned the order of nature according to our private principles of œconomy: for the Laplanders have one way of living; the European huſbandman another; the Hottentots and ſavages a third; whereas the ſtupendous œconomy of the Deity is one throughout the globe; and if Providence does not always calculate exactly according to our way of reckoning, we ought to conſider this affair in the ſame light, as when different ſea-

men

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men wait for a fair wind, every one with refpect to the part he is bound to, who we plainly fee cannot all be fatisfied.

2. The whole earth would be overwhelmed with carcafes and ftinking bodies, if fome animals did not delight to feed upon them. Therefore, when an animal dies, bears, wolves, foxes, ravens, &c. do not lofe a moment till they have taken all away. But if a horfe *e. g.* dies near the public road, you will find him, after a few days, fwoln, burft, and at laft filled with innumerable grubs of carniverous flies, by which he is entirely confumed, and removed out of the way, that he may not become a nuifance to paffengers by his poifonous ftench.

When the carcafes of fifhes are driven upon the fhore, the voracious kinds, fuch as the thornback, the hound-fifh, the conger-eel, &c. gather about and eat them. But becaufe the flux and reflux foon change the ftate of the fea, they themfelves are often detained in pits, and become a prey to the wild beafts that frequent the fhores. Thus the earth is not only kept clean from the putrefaction of carcafes, but at the fame time, by the œconomy of nature, the neceffaries of life are provided for many animals. In the like manner many infects at once promote their own good, and that of other animals. Thus gnats lay their eggs in ftagnant, putrid, and ftinking waters, and the grubs that arife from thefe eggs clear away all the putrefaction: and this will eafily appear, if any one will make the experiment by filling two veffels with putrid water, leaving the grubs in one, and taking them all out of the other; for then he will foon find the water that is full of grubs pure and without any ftench, while the water that has no grubs will continue ftinking.

Lice increafe in a wonderful manner in the heads of children that are fcabby; nor are they without their ufe, for they confume the redundant humours.

The beetle kind in fummer extract all moift and glutinous matter out of the dung of cattle, fo that it becomes like duft, and is fpread by the wind over the ground. Were it not for this, the vegetables that lie under the dung would be fo far from thriving, that all that fpot would be rendered barren.

As the excrements of dogs is of fo filthy and feptic a nature that no infect will touch them, and therefore they cannot be difperfed by that means, care is taken that thefe animals fhould exonerate upon ftones, trunks of trees, or fome high place, that vegetables may not be hurt by them.

Cats bury their dung. Nothing is fo mean, nothing fo little, in which the wonderful order and wife difpofition of nature do not fhine forth.

Laftly, all thefe treafures of nature, fo artfully contrived, fo wonderfully propagated, fo providentially fupported throughout her three kingdoms, feem intended by the Creator for the fake of man. Every thing may be made fubfervient to his ufe, if not immediately, yet mediately; not fo to that of other animals. By the help of reafon man tames the fierceft animals; purfues and catches the fwifteft; nay, he is able to reach even thofe which lie hid in the bottom of the fea.

By the help of reafon, he increafes the number of vegetables immenfely; and does that by art, which nature, left to herfelf, could fcarcely effect. By ingenuity he obtains from vegetables whatever is convenient or neceffary for food, drink, cloathing, medicine, navigation, and a thoufand other purpofes.

He has found the means of going down into the abyfs of the earth, and almoft fearching its very bowels. With what artifice has he learned to get fragments from the moft rocky mountains, to make the hardeft ftones fluid like water, to feparate the ufeful metal from the ufelefs drofs, and to turn the fineft fand to fome ufe! In fhort, when we follow the feries of created things, and confider how providentially one is made for the fake of another, the matter comes to this, that all things are made for the fake of man; and for this end more efpecially, that he, by admiring the works of the Creator, fhould extol his glory, and at once enjoy all thofe things of which he ftands in need, in order to pafs his life conveniently and pleafantly.

Befides general natural hiftories, which we have here given a fpecimen of, as thofe of Pliny, &c. there are likewife particular ones; and thofe of two kinds. The firft, thofe which only confider one kind of things; fuch as the Hiftory of Shells, by Dr Lifter; of Fifhes, by Willughby; that of Birds, by the fame; that of Plants, by Ray; thofe of Infects, by Swammerdam and Mouffet; that of Animals, by Gefner; that of Foffils, by Agricola, Mercatus, &c.

The fecond, thofe which confider the feveral kinds of natural things found in particular countries or provinces: as, the Natural Hiftory of Dauphiné, by Chorier; the Natural Hiftory of the Antilles, by F. Du Tertre, and M. Lonvillers De Poincy; that of Oxfordfhire and Staffordfhire, by Dr Plott; that of Lancafhire, by Leigh; of Northamptonfhire, by Morton; that of the Weftern Iflands, by Martin, &c.

The natural hiftory only of one particular place, is a fubject very extenfive in its materials, and not to be fet about without great care and circumfpection. Mr Boyle has favoured the world with a lift of the heads under which to arrange things, and what to enquire after on fuch an occafion.

The general heads under which he comprehends the articles of this hiftory are four; the things which regard the heavens, the air, the waters, and the earth.

To thefe general heads Mr Boyle imagines fhould be added, inquiries into traditions in the country, of any thing relating to it, whether peculiar to it, or only more common there than elfewhere; and where thefe require learning or fkill in the anfwerer, the utmoft care is to be taken to put the people in a way to give their accounts in a fatisfactory manner; for a falfe or bad account of any thing is always much worfe than no account at all.

This fubject concerning the works of nature, a very fmall part of which we have been able to touch upon, is of fuch importance and dignity, that if it were to be properly treated in all its parts, men would find wherewithal to employ almoft all the powers of the mind: nay, time itfelf would fail before, with the moft acute human fagacity, we fhould be able to difcover the amazing œconomy, laws, and exquifite ftructure, even of the leaft infect; fince, as Pliny obferves, nature nowhere appears more herfelf than in her moft minute works.

Summary

Summary as it is, however, the preceding view, as it were in a map, of the feveral parts of nature, their connections and dependencies, may at leaft, perhaps, convey an ufeful leffon, and fuch an one as the beft of us often need to have inculcated.

From a partial confideration of things, we are very apt to criticife what we ought to admire; to look upon as ufelefs what perhaps we fhould own to be of infinite advantage to us, did we fee a little farther; to be peevifh where we ought to give thanks; and at the fame time to ridicule thofe who employ their time and thoughts in examining what we were (*i.e.* fome of us moft affuredly were) created and appointed to ftudy. In fhort, we are too apt to treat the Almighty worfe than a rational man would treat a good mechanic, whofe works he would either thoroughly examine or be afhamed to find any fault with. This is the effect of a partial confideration of nature; but he who has the candour of mind and leifure to look farther, will be inclined to wonder and adore, and even to cry out with the poet,

How wond'rous is this fcene! where all is form'd
With number, weight, and meafure! all defign'd
For fome great end! where not alone the plant
Of ftately growth; the herb of glorious hue,
Or food-full fubftance; not the labouring fteed;
The herd, and flock, that feed us; not the mine
That yields us ftores for elegance and ufe;
The fea that loads our table, and conveys
The wanderer man from clime to clime; with all
Thofe rolling fpheres, that from on high fhed down
Their kindly influence: not thefe alone,
Which ftrike ev'n eyes incurious; but each mofs,
Each fhell, each crawling infect, holds a rank
Important in the plan of Him who fram'd
This fcale of beings; holds a rank, which loft
Would break the chain, and leave behind a gap
Which nature's felf would rue. Almighty Being,
Caufe and fupport of all things, can I view
Thefe objects of my wonder, can I feel
Thefe fine fenfations, and not think of thee?
Thou who doft thro' th' eternal round of time,
Doft thro' th' immenfity of fpace exift
Alone, fhalt thou alone excluded be
From this thy univerfe? Shall feeble man
Think it beneath his proud philofophy
To call for thy affiftance, and pretend
To frame a world, who cannot frame a clod?—
Not to know thee, is not to know ourfelves——
Is to know nothing—nothing worth the care
Of man's exalted fpirit—All becomes,
Without thy ray divine, one dreary gloom,
Where lurk the monfters of fantaftic brains,
Order bereft of thought, uncaus'd effects,
Fate freely acting, and unerring Chance.
Where meanlefs matter to a chaos finks,
Or fomething lower ftill: for without thee
It crumbles into atoms void of force,
Void of refiftance—it eludes our thought.
Where laws eternal to the varying code
Of felf-love dwindle. Intereft, paffion, whim,
Take place of right and wrong: the golden chain
Of being melts away, and the mind's eye
Sees nothing but the prefent. All beyond
Is vifionary guefs—is dream—is death.

THOMSON.

We fhall add to this article the following defcription of a mufeum: The windows ought to be in the two longeft fides of the building, that it may be equally lighted during the whole day.

On one wing of the mufeum muft be placed eleven preffes, with fhelves fupported on wooden brackets. Thefe preffes are intended for containing the eleven following claffes of the *mineral kingdom* (a kingdom which forms the original bafis of every thing pertaining to this globe: minerals have neither organization nor life), *viz.*

1. Waters.	7. Semimetals.
2. Earths.	8. Metals.
3. Sands.	9. Bitumens and fulphurs.
4. Stones.	10. Volcanic productions.
5. Salts.	11. Petrifactions, foffils, and *lufus naturæ*.
6. Pyrites.	

We at once perceive the advantage of fuch an arrangement, where every thing is diftinct and diftributed in the manner moft advantageous for the infpection of the ftudent. The preffes muft be provided with a wire grate, or covered with glafs; and each of them muft have a title on the cornice, indicating the clafs which it contains. Befides this, each fhelf in the prefs ought to have a fmall title on the edge, fpecifying the kind of fubftances which are placed on it; and thefe fhould be kept in clear glafs-bottles, well fealed and furnifhed with proper titles alfo. In them are to be feen earths, clays, turfs, ochres, chalks, marls, lapis ollaris, and micaceous ftones, calcareous or limeftones, fpars, congelations, ftony refidua, ftalactites, alabafter, gypfum or plafter-ftone, flints, rock-ftones, rock and mineral cryftals, falts, and pyrites fubject to efflorefcence, coals and other bituminous bodies, lava, and the drofs of volcanoes. In the bottom of each prefs two fpaces may be referved and furnifhed with a confiderable number of fmall femicircular fhelves, where pieces much efteemed, and in complete prefervation, may be placed by themfelves or on very fmall pedeftals; fuch as tranfparent mineral falt, collections of coloured pyrites, the ftone called the *Inca's*-ftone, beautiful fpecimens of cobalt, bifmuth, zinc, antimony, ore of fluid, quickfilver, and cinnabar in cryftals: the whole properly titled and arranged according to their claffes.

The prefs for *metals* ought to prefent us in the fame order with felect and rare fpecimens of the ores of white, green, &c. lead, the ore of nickel, collections of cryftallifed tin, the *flos-ferri*, beautiful needles of hematite, a powerful rough loadftone, with fome platina, the filky copper of China, and a collection of malachite; likewife virgin filver in vegetation and red filver, together with a collection of golden ore. Thefe fubftances form a fpectacle equally varied and inftructive: in this department of her works nature is as rich and brilliant as in the various kinds of ftones.

The prefs for *bitumens* may in like manner contain fpecimens of jet polifhed on one fide; amber of different colours (which when it is tranfparent, and contains infects, ought to be polifhed on the two oppofite furfaces); a beautiful fpecimen of ambergris, together with pieces of tranfparent red and yellow fulphur.

In the prefs for *petrifactions* or for *foffils*, we muft likewife place, on femicircular fhelves, the rareft and the

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the best preserved pieces; such as lilium lapideum, madrepores, transparent belemnites, fossil urchins, the articulated nautilus, cornua ammonis sawed and polished, hysterolite, lapis lenticularis, gryphites calculi or bezoars, turquoises, loadstones, glossopetræ; in short, all kinds of figured stones, and also petrified wood.

In the press for *stones*, which has a similar apparatus of shelves, we see different kinds of crystals, and all the precious stones in their matrix. Those which are detached and uncut are placed in cases or watch-glasses; but those which have been cut and set are to be put in a jewel-box or open case for rings. The same is to be observed with regard to pieces, cups, cisterns, or polished plates of agate, cornelian, jade, sardonyx, onyx, chalcedony, jasper, porphyry, granite, lapis lazuli, marble, alabaster, and Iceland crystal. Here likewise are to be placed the Bologna stone, the Labrador stone, the serpentine stone, talc, amianthus, zeolite, basaltes, touch-stone, together with Egyptian and English flints. With regard to impressed petrifactions, large arborizations, and Florence stones, if they are in good preservation: they should be framed and suspended by hooks on the pilasters which connect the presses of the mineral kingdom. These presses are of an uniform height; but their breadth is proportioned to the size or number of the materials composing the class which it contains, and they are supported, as well as those which are placed all around, on a chest of drawers breast high. These drawers must correspond to the presses above them, and contain substances of the same class. This methodical arrangement is a great help to the memory; because it occasionally supplies the place of a numbered catalogue, and because in a great multitude of objects it is the only means of finding at once what we want.

In the mineral kingdom, these drawers are very useful for containing earths, belemnites, entroches, astroites, and other polymorphous fossils, univalve, bivalve, and multivalve shells, polished petrifactions of bones and pieces of wood, collections of marbles and polished flints, collections of silex, sands, and amber, together with pieces procured from the melting of ores, such as regulus, dross, &c. Some parts of the mineral kingdom, such as the earths and certain stones, make not a brilliant figure in a museum; they are notwithstanding the most scientific parts of it, and the most interesting to those who prefer the solid satisfaction of tracing nature in her most important productions, and her fundamental operations, to the empty spectacle of gaudy colours and agreeable figures.

Minerals in general require to be kept with great care, and so as not to be intermixed. Some of them, such as the salts, easily dissolve; and others, as the pyrites, are subject to efflorescence. Vegetables and animals are likewise more or less liable to corruption; and to prevent this inconvenience, great pains must be taken in preserving certain pieces which are subject to speedy decay.

On the *second* wing of the cabinet are to be placed ten presses, distributed like those of the mineral kingdom, and intended for containing the ten following divisions of the *vegetable kingdom*. Vegetables are organised bodies, but they possess not, like animals, spontaneous motion or feeling.

1. Roots.
2. Barks.
3. Woods and stalks.
4. Leaves.
5. Flowers.
6. Fruits and seeds.
7. Parasite plants, also agarics and mushrooms.
8. The juices of vegetables; such as balsams and solid resins, resinous gums, and gums properly so called.
9. Extracted juices, sugars, and dregs.
10. Marine plants, and plants growing on the shores of the sea.

In this kingdom, the same order of presses, the same symmetry and arrangement, are to be observed as in the mineral kingdom. The semicircular shelves in the bottom of the presses are here very useful for containing in small square phials China varnish, essential oils, and other peculiar aromatics, whether of Arabia or India; together with the roots of cumbou, mandragora, certain fruits, either monstrous or natural, which grow in the East Indies, and which the natives ripen in large bottles with narrow necks, preserved in spirits, such as the cashew-nut, &c. Here likewise are placed a number of fruits, remarkable for their rarity or great size; as cocoa nuts, gourds, the fruit of the bastard locust-tree, the fruit of the sand-box-tree, banana figs, pine-apples, coloquintida apple, dogsbane, vegetable tumors or wens, and a branch of *bois de dentelle*, in which the three parts of the bark, especially the *liber*, are distinctly separated.

As the number of vegetables greatly exceeds that of minerals, we seldom put any thing in bottles but the dried parts of exotic plants, which are used either in medicine or in the arts, and those likewise which we cultivate merely from curiosity. With regard to indigenous plants, an *herbal* is formed of land and sea plants, pasted or laid between leaves of paper collected into the shape of a book, and arranged according to the system of the best botanists. To make this herbal as convenient as possible, it is proper to put the dried plants between two folds of dry paper, and, arranging them according to their families, genera, and species, to pile them one above another, either openly on the shelves or in large band-boxes. On the back of the band-boxes must be a title indicating the family, at the extremity another with the name of the genus, and on each leaf the name of the species which it contains: the paper must be loose, that they may be changed at pleasure. The drawers are useful partly for holding different kinds of woods with the bark, cut in such a manner as that the grain and contexture of it may easily be distinguished, and for containing a collection of the woods of both Indies in small polished pieces with proper titles. One part of the drawers has several divisions within for the purpose of holding seeds; and a small title is inscribed on each of these divisions.

Sea-weeds, and small marine plants of an elegant shape, which from their colour and variety form agreeable pictures, may be framed and suspended by hooks to the pilasters of the presses. In the animal kingdom, particularly insects, it is well known, are attended with irreparable devastations. Butterflies, still

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ſtill more than the moſt beautiful birds, are not only ſubject to deſtruction in this way, but are alſo expoſed to great danger from the rays of the ſun, either direct or reflected, which alter their colour, make them loſe all their ſplendor, and, in ſome ſpecies, render it impoſſible to diſtinguiſh them. In general, we cannot prevent the deſtruction of vegetables and animals, but by drying them as much as poſſible, or by putting them in prepared liquors, which muſt not be allowed to evaporate. But dried animals and vegetables require ſtill greater care: a great multitude of inſects which are bred in the month of April feed upon them, and deſtroy them internally before they are perceived: they ought to be carefully watched during the continuance of this plague, which is about five months. In like manner, the moiſture of winter and the heat of ſummer make it neceſſary that the preſſes of muſæums ſhould be kept carefully ſhut, except perhaps thoſe which front to the north. Beſides, the vapour of ſulphur in combuſtion will kill theſe deſtructive inſects either before or after they become perfect ones: the fumigations muſt be carefully performed during dry weather, and in a box made on purpoſe, into which only the ſpecimens attacked are introduced.

On the third wing of the cabinet are placed preſſes for containing the ten following diviſions of the *animal kingdom* (a kingdom which derived the ſubſtance neceſſary to its exiſtence either mediately or immediately from the vegetable kingdom.——Animals poſſeſs feeling and ſpontaneous motion.)

1. Lithophytes.
2. Zoophytes.
3. Teſtaceous animals.
4. Cruſtaceous animals.
5. Inſects.
6. Fiſhes.
7. Amphibious animals, reptiles, and oviparous quadrupeds.
8. Birds, with their neſts and eggs.
9. Viviparous quadrupeds.
10. Man.

In theſe preſſes the ſame external decoration and diſtribution may be obſerved as in the preceding ones.

The preſs for the *lithophytes* muſt be arranged in ſuch a manner as to preſent at one view the hiſtory of lithophytes, mandreporæ, and coral either rough or ſtript of its covering; the whole placed on ſmall wooden pedeſtals, blackened or gilded. Corallines, as well as fuci, may be paſted on a bit of paper, and put into a frame: ſuch pictures, when ſuſpended by hooks to the outſide of the pilaſters, always attract the attention of the ſpectators. If we have a conſiderable collection of them, it will be neceſſary to make a kind of herbal of them.

The preſs for *zoophytes* contains ſponges, the marine jet d' eau, the penna marina, holothuriæ, and all thoſe ſubſtances which are called *animal plants*, molluſcæ, worms, &c. Theſe productions muſt be preſerved in rectified ſpirit of wine, which will be ſufficiently weakened by the water contained in them. Upon the ſides are ſea-ſtars, both prickly and ſmooth, with ſeveral rays, a Meduſa's head, &c.

The *teſtaceous* animals are preſerved in bottles among ſpirits. On the ſemicircular ſhelves at the bottom of the preſs are placed large ſhells, and ſmall ones with their marine covering.

The preſs for *cruſtaceous* animals conſiſts almoſt entirely of ſemicircular ſhelves; and contains crabs, crayfiſh, &c. Small lobſters, ſquillæ, and all ſmall cruſtaceous animals, excepting the hermit crab, are put in frames.

Two kinds of inſects are found in the preſs deſtined for them. The firſt kind, after being dried, are put in ſmall wooden frames, which are varniſhed and glazed on two ſides, that we may have it in our power to examine the inſect on both ſides: of this kind are flies, mantes, beetles, butterflies with their nymphæ or chryſalides, &c. (Theſe animals form the moſt brilliant part of the cabinet, while the preſs for birds is the moſt ſtriking; but great pains muſt be uſed in their preſervation.) Other inſects, ſuch as graſhoppers, ſcolopendræ, ſcorpions, ſalamanders, ſpiders, tarantulas, caterpillars, and eſpecially all ſoft inſects, muſt be preſerved in ſpirits, and placed on ſemicircular ſhelves at the bottom of the preſs. Here alſo are depoſited honey-combs, waſps neſts, and branches furniſhed with the neſts of thoſe inſects which produce the gum-lac.

In the preſs for *fiſhes* are to be ſeen bottles containing foreign fiſhes, which are always ſent home in ſpirits. The ſoft fiſhes of our own country are preſerved in the ſame manner. The ſkin of large fiſhes, whether found in ſalt or freſh-water, is taken off and paſted on a bit of paper: the two parts are ſometimes ſewed together, and the colours are renewed by means of varniſh. The flying fiſh muſt be ſuſpended about the top of the preſs; and armed fiſhes, with oſtracia, on the ſhelves below.

The preſs for *amphibious* animals contains, in bottles full of ſpirit of wine diluted with alum water, ſerpents, vipers, adders, frogs, toads, lizards, ſmall land or water turtles, and a ſmall tortoiſe with its ſhell. The lower ſhelves are furniſhed with a ſmall rattle-ſnake, a cameleon, a crocodile, a beaver, a ſea-lion, a ſea-calf, &c.

The preſs for *birds* is filled with animals of that claſs, both foreign and natives, ſtuffed and provided with glaſs eyes. The ſkin covered with the feathers may be preſerved perfect and dry by being fitted to a mould of tree-moſs, or filled with cotton, and ſprinkled on the inſide with pepper, camphire, and corroſive ſublimate, to defend it from the attack of moths, grubs, wood-lice, and dermeſtes. The ſpring and autumn are the beſt ſeaſons for this operation; the moulting-time is very improper, becauſe it is unfavourable to the beautiful colour and the preſervation of the feathers, which moreover are then full of blood. The birds, when thus prepared, and when the brain has been taken out, are then placed on their ſupports.——Some females may be placed in their neſts in the attitude of incubation; thoſe which are accuſtomed to perch may be placed on artificial trees; a wooden ſupporter, covered with moſs, turf, or artificial reeds, may be given to thoſe which live among ſuch plants.——Swimming birds are placed on the lowermoſt ſhelves, which muſt be covered with pieces of mirrors or ſilver gauze, in imitation of water. We muſt be careful to give each animal the moſt pictureſque attitude; to preſerve the proportions, together with the natural poſition of the legs, wings, head, body, and feathers; to obſerve an equilibrium in thoſe which are at reſt, and to avoid it in thoſe which have a fighting attitude.——We muſt characterize the animal, repreſent his genius,

dispositions, graces, boldness, or timidity. In short, we must endeavour to express that beautiful *tout ensemble* which gives the appearance of life and motion to the whole. The deception ought to be such, that those who examine the particulars of the collection may apply to each what was said on another occasion—*Nature is dead, but Art is alive.* These observations on birds are equally applicable to the other animals; but all of them must be arranged in a methodical order, which possesses the advantage necessary in such collections of uniting pleasure with instruction.

The lower shelves contain the eggs and nests of birds; and a collection of feathers is made in a book in the same manner as an *herbal.*

The press for *quadrupeds* contains, preserved in bottles, small animals, such as mice, rats, the opossum, &c. Other animals are stuffed, such as the cat, the squirrel, the hedge-hog, the porcupine, the armadillo, the Guinea pig, the wolf, the fox, the roe-buck, the hare, the dog, &c.

The press containing the *history of man* consists of a complete myology, of a head separately injected, of a brain and the organs of generation in both sexes, of a neurology, an osteology, embryos of all different ages, with their after-births, monstrous fœtuses, and an Egygtian mummy. Here likewise are put beautiful anatomical pieces in wax or wood, and stony concretions extracted from the human body.

The preservation of subjects in bottles with spirit of wine does not always succeed, because they spoil as the spirit of wine evaporates, unless particular care be taken to examine the vessels wherein they are contained, which requires time and pains, and is attended with expence. Mr Lewis Nicola, in the Philadelphia Transactions for the year 1771, recommends, after using the different methods pointed out by M. Reaumur, of putting subjects intended for preservation in bottles filled with spirit of wine, to wipe well the neck of the bottle, and put a layer of putty, two lines thick, over the piece of skin or bladder which covers it. The bottle is then reversed in a wooden cup, which they fill with melted tallow, or with a mixture of tallow and wax, to prevent the spirit of wine from evaporating.

The drawers under the presses of the *animal kingdom* contain small detached parts of animals, such as teeth, small horns, jaw-bones, claws, beaks, nails, vertebræ, hairs, scales, balls of hair, and a collection of bones remarkable for blows, fractures, deformities, and diseases.

To decorate a cabinet to the greatest advantage, and to make one complete whole, the walls must be furnished throughout their whole extent. For this purpose the tops of the presses are commonly ornamented with shells of a very great size, foreign wasps-hives, the horn of a rhinoceros, an elephant's trunk, the horn of an unicorn, urns and busts of alabaster, jasper, marble, porphyry, or serpentine stone. Here likewise are placed figures of antique bronze, large lithophytes, animals made of shells, bouquets made of the wings of Scarabæub gourds cut into two, painted, and made into bowls, plates, vases, and as they are used by savages; little trunks of bark, books made of the leaves of the palm-tree, globes, spheres, &c. The multiplicity and singularity of the objects never fail to arrest the attention of the spectator.

The circumference of the cabinet being furnished in the manner we have described, the floor may likewise be paved with different kinds of common stones which are susceptible of a polish.

The cieling, which must be very white, is divided into three spaces, furnished with hooks and brass wires. Here may be distributed in order different vegetable and animal productions, which are of too great a size to be contained in the presses; such as,

1. The sugar-cane, a branch of the palm-tree, together with that called the *Chinese fan*, large cocoas, both simple and with a double lobe, the leaf of the banana-tree, Indian and European sticks, remarkable for the knots, tubercles, and spiral wreaths, which cover their whole length, a bamboo root divided longitudinally into two parts, and the different species of reed-canes.

2. The skins of large animals; also stuffed animals, such as lizzards, whether a crocodile or caiman and scaly lizard, a shark, a sword-fish, a sea-calf, a sea-tortoise, large and long serpents, the horns of deer, wild goats, roe-bucks, and rein-deer.

3. The third space is filled with Indian rackets, hammocks, dresses, and tufts of feathers; with calumets or pipes; with quivers, bows, and arrows; with head-pieces, caps with feathers, aprons, necklaces, Chinese necessaries, fans made of the leaves of the palm tree, a gargoulette of Indostan, a Polish whip, Indian canoes, Chinese musical instruments, lances, weapons, Indian furniture and utensils; and in short, various curiosities from nations ancient and modern, if they can be found; various furniture and utensils of different nations, ancient and modern.

As the great extent of a fine collection requires that there be no empty space, stands may be placed in different parts of the room, especially at the corners, for supporting large vertebræ, the head of a sea-cow, very large madrepores, or considerable collections either of rock chrystal or of minerals.

In the middle of the room is placed a receptacle for shells, which is a large table or bureau with raised edges. The surface of this table is divided into 27 separate cases, of different sizes, and proportioned to the 27 families of marine shells to be deposited in them. These divisions are made with wood or pasteboard painted blue, and are sometimes in the form of shelves; the bottom is covered with blue cotton or green sattin, or, what is still simpler, with white linen, sufficiently rough to keep the shells in their place. In some cabinets, these shelves are covered with mirrors on all their different surfaces, which shows the objects double, and gives us an opportunity of viewing them on the two opposite sides. In other cabinets, the cases for each family are distributed into a number of smaller divisions, for containing the several species separate from each other. The sea-shells, contained in the receptacle for shells, are all cleaned, and present, in the variety of their figure and colours, together with their inequality, an agreeable and enchanting picture, so much the more charming that it unites a methodical distribution to a symmetrical order. The upper part of this table is shut by a net-

work of brafs wire covered with ferge, or, what is ftill better, by a glafs frame, to defend the fhells from duft. We muft not omit to mention, that in the middle of the table there is a long elevated fquare box, containing land and river fhells. From the middle of each compartment, or at each family of fhells, arifes a fmall pyramidal wooden pillar, on the top of which is an horizontal piece of pafteboard, or fort of fign, denoting the kind of fhells belonging to that divifion. Each family is diftinguifhed from the adjoining one by thofe kind of ornaments of filk called *caterpillars*. By means of the different tints, we perceive the limits and extent of each family in the fame manner as the colours in a geographical map enable us to diftinguifh the feveral provinces of the fame empire. An exhibition of this kind was to be feen from 1768 to 1774, in a mufeum belonging to the prince of Condé at Chantilly.

Under the table for fhells, on the fide of the windows, is a glazed cage, large enough to contain the fkeletons of an animal belonging to each clafs, to wit, a fifh, an amphibious animal, a reptile, a lizard, a bird, and a quadruped. When to thefe we can add, for the fake of the comparative ofteology, the fkeletons of the intermediate individuals of thefe animals, together with thofe which make the neareft approaches to man, fuch as the *monkey* and the *bear*, we greatly increafe both the pleafure and inftruction. Below this table are likewife placed the beft books connected with the different branches of natural hiftory, efpecially fuch as have illuminated plates. The difficulty of acquiring the moft valuable objects, and of preventing their deftruction when once acquired, obliges us to have recourfe to figures, in order to preferve a reprefentation of them. This is an infallible method of communicating, not only to our cotemporaries, but alfo to pofterity, the difcoveries of the age in which the work was compofed. Here alfo may be depofited the *herbal* and the collection of *feathers*, arranged in the form of books.

The fpace above the door is furnifhed with a large frame, filled with the fkins of rare fifhes, which are dried, varnifhed, and pafted on paper.

The piers of the windows are furnifhed with one or two preffes, which are provided with fhelves, and contain different kinds of inftruments employed in phyfics, fuch as an air-pump, a burning mirror, a perfpective glafs, a magnifier, a microfcope, a telefcope, magnets both natural and artificial, &c.

On the femicircular fhelves below are placed ftones formerly ufed by favages for hatchets. Some curious pieces of lacker work, Indian pagodas, trinkets belonging to the favages of the north and to the Chinefe, which are made of ivory or yellow amber, or of coral mounted with gold, filver, porcelain-clay, *kriacks* of Siam, and Turkifh *cangiars*, which are a kind of poniards, Indian curiofities of filver, and the galians which the Turks and Perfians ufe in fmoking tobacco and aloes.

The drawers under this prefs contain a collection of medals, china ink, lachrymatory phials, and the moft beautiful engraved ftones of Europe, or an impreffion of them in wax or fulphur, counters, cameos, antiques, talifmans, ancient weights and meafures, idols, urns, lamps, inftruments of facrifice, and falfe jewels.

Laft of all, the embrafures of the windows muft be furnifhed with pictures of ftone in connected pieces. Here likewife, as well as in the embrafures and pannels of the door, may be put tubes hermetically fealed, containing rare reptiles preferved in proper liquors.

The reader will by this time have fome idea of the prodigious extent of the fcience of natural hiftory; fo extenfive is it, indeed, that the longeft life is far from being fufficient to enable us to acquire a perfect knowledge of it: it is important beyond difpute, becaufe its bufinefs is with the works of God. In all the articles connected with the prefent, as forming particular parts of it, and to which we refer, we have made great ufe of the works of the celebrated Linnæus, who it is well known arranged the three kingdoms into regular fyftems, of which botany is the moft complete. The world in general feems to have been moft diffatisfied with the animal kingdom: he himfelf, in the courfe of a variety of editions, made many important alterations. Some men of confiderable note, for example Buffon, have written on this fubject without any regard to fyftematic arrangement. Dr Berkenhout's works on this part of fcience are very ufeful; in a particular manner, becaufe he tranflates Latin names, &c. Bomare's new edition of his Natural Hiftory, in 15 vols. octavo, a work of confiderable importance, was publifhed in 1791.

The moft complete fyftem, however, of natural hiftory which has been yet given to the public, is undoubtedly that of Linnæus, in his *Syftema Naturæ*, of which a new and improved edition is actually publifhing by —— Gmeling. A fhort view of this elaborate work will, we prefume, not be unacceptable to the reader, as it will prefent him, in a very fmall compafs, an abftract of whatever is at prefent known in the fix firft claffes of natural hiftory.

Class I. *Mammalia.*

Ord.	Gen.	Sp.
Primatis	4	88
Bruta	7	25
Feræ	10	186
Glires	10	129
Pecora	8	90
Bellucæ	4	25
Cete	4	14
7	47	557

Class II. *Aves.*

Ord.	Gen.	Sp.
Accipitus	4	271
Picæ	23	663
Anferes	13	314
Grallæ	20	326
Gallinæ	10	129
Pafferes	17	983
6	87	2686

Class III. *Amphibia.*

Ord.	Gen.	Sp.
Reptilia	4	147
Serpentes	6	219
2	10	366

Class IV.

Animal Kingdom.

Class IV. *Pisces.*

Ord.	Gen.	Sp.
Apodes	10	37
Tugulares	6	52
Thoracici	19	452
Abdominales	16	202
Branchioftegi	10	81
Condropterygii	5	65
6	66	889

Class V. *Infectæ.*

Ord.	Gen.	Sp.
Coleoptera	55	4048
Hemyptera	14	1464
Lepidoptera	3	2600
Neuroptera	7	174
Hymenoptera	15	1239
Diptera	12	692
Aptera	15	679
7	121	10896

Class VI. *Vermes.*

Ord.	Gen.	Sp.
Inteftina	21	384
Mollufca	31	438
Teftacea	36	2525
Zoophita	15	498
Infuforia	15	191
5	118	4036

In the new French *Encyclopédie par oidre de Matieres*, the editors promifed to give a defcription of more than 18,000 plants. Dr Berkenhout, in the laft edition of his Synopfis, fays, that in Great Britain and Ireland there are about 54 fpecies of the mammalia, 250 of birds, 50 of the amphibia, 600 of infects, 150 of fifhes, and 1600 fpecies of plants: but in every clafs he is probably much within the number.

Natural Philofophy.

Natural *Philofophy*, is commonly defined to be that art or fcience which confiders the powers and properties of natural bodies, and their mutual actions on one another. The province of moral philofophy is the mind of man; its inquiries and refearches are into the intellectual world. Natural philofophy, on the other hand, is only concerned with the material part of the creation. The Moralift's bufinefs is to inquire into the nature of virtue, the caufes and effects of vice, to propofe remedies for it, and to point out the mode of attaining happinefs, which only can be the refult of virtuous conduct. The Naturalift, on the contrary, has nothing to do with fpirit; his bufinefs is folely about body or matter; and he ought to have a folid and accurate knowledge of all material fubftances, together with their affections and properties; and, if poffible, he is to inveftigate the reafons of fuch and fuch appearances.—Indeed, the firft and principal part of this fcience is to collect all the manifeft and fenfible appearances of things, and reduce them into a body of natural hiftory. Philofophy, it has often been faid, and it is even now very generally thought, to mean an inquiry into all the caufes of things; but experience informs us, that though we are acquainted with a good number of effects, we can trace but few of their caufes; fo that philofophy itfelf will really be found to be in general but a collection of facts. Still, however, it differs from natural hiftory in its appropriated fenfe; the bufinefs of which is only to obferve the appearances of natural bodies feparately, and from thefe appearances to clafs them with other bodies: natural philofophy goes farther, and recites the action of two or more bodies of the fame or different kinds upon one another; and though it can neither inveftigate nor point out the caufes of thofe effects, whatever they are, yet, from mathematical reafoning combined with experience, it can be demonftrated, that in fuch circumftances fuch effects muft always take place. There are evidently two ways of making obfervations on the material world: the firft is, when we view things nearly as they happen to turn up, without any defign or intervention of our own; in which way, indeed, no great improvements can be expected in the art, becaufe chance having the direction, only exhibits occafional or extemporary properties. The other method is, when, after a thorough acquaintance with bodies, we apply them to other bodies equally known, diligently attending to the refult, and obferving whether any thing new arifes. Such feems to be in general the nature of our article; nor is it our intention to be much more particular at prefent. We muft therefore refer our readers refpectively to thofe parts of the fubject, refpecting which they wifh for more fatisfaction and minuter details. The ancient and modern definitions of the word *philofophy*, together with its origin, as well as the manner of philofophifing in former times as well as at prefent, with the gradual improvement of fcience, particularly natural, we fhall introduce, we think, more properly under the words Philosophy and Physics. We need only add under the prefent article, what however is well known, that natural philofophy was till lately divided only into four parts, commonly called the *four branches*, viz. 1. Mechanics; 2 Hydroftatics; 3, Optics; and 4. Aftronomy; and thefe again are fub-divided into various parts. Modern difcoveries have added, however, two more parts to the number, viz. magnetifm and electricity, whofe properties and effects, &c. have been wonderfully unfolded of late years.—It is remarkable, that in the Englifh univerfities thefe two latter branches are never taken notice of in lecturing on natural philofophy, the old divifion being ftill retained, without any mention of thefe two important articles. The reafon may be, that they are only fubject to experiment, and not yet reduced to mathematical reafoning; which is the method of teaching philofophy in one of thofe celebrated feminaries. Of thefe branches of this extenfive fcience, it is not our intention to take even a general view in this place. We muft

muft therefore refer our readers to each particular article, where they will find them treated at confiderable length—See *Experimental Philofophy*.

NATURALIZATION, in law, the act of naturalizing an alien, or putting him into the condition of a natural-born fubject, and intitling him to the rights and privileges thereof. But none can be naturalized unlefs they have received the facrament within one month before the bringing in of the bill, and taken the oaths of allegiance and fupremacy in the prefence of the parliament. A perfon who is naturalized may have lands by defcent, as heir at law, as well as obtain them by purchafe; but he is difabled from being a member of the privy council or parliament; or from holding offices, 7 Jac. I. cap. 2. 12 Will. III. cap. 2. All children born out of the king's dominions, whofe fathers were or are fubjects of this kingdom at the time of their birth, are adjudged to be natural born fubjects of this realm, except children of parents attainted of treafon, or that are in the actual fervice of a foreign prince at enmity with us, 4 Geo. II. cap. 21. Every foreign feaman, who in time of war ferves two years on board an Englifh fhip, is *ipfo facto* naturalized, 13 Geo. II. cap. 3. And all foreign Proteftants and Jews, upon their refiding feven years in any of the Britifh colonies, without being abfent above two months at a time, or ferving two years in a military capacity there, are upon taking the oaths naturalized to all intents and purpofes, as if they had been born in this kingdom; and therefore are admiffible to all fuch privileges, and no other, as Proteftants or Jews born in this kingdom are intitled to. See Alien and Denizen.

In France, before the Revolution, naturalization was the king's prerogative; in England it is only done by act of parliament. In the former of thofe places, before their government was overturned, Swifs, Savoyards, and Scots, did not require naturalization, being reputed regnicoles, or natives.

NATURALS, among phyficians, whatever naturally belongs to an animal, in oppofition to non-naturals. See Non-naturals.

NATURE, according to Mr Boyle, has eight different fignifications; it being ufed, 1. For the Author of nature, whom the fchoolmen call *Natura Naturans*, being the fame with God. 2. By the nature of a thing, we fometimes mean its effence; that is, the attributes which make it what it is, whether the thing be corporeal or not; as when we attempt to define the nature of a fluid, of a triangle, &c. 3. Sometimes we confound that which a man has by nature with what accrues to him by birth; as when we fay, that fuch a man is noble by nature. 4 Sometimes we take nature for an internal principle of motion; as when we fay, that a ftone by nature falls to the earth. 5. Sometimes we underftand, by nature, the eftablifhed courfe of things. 6. Sometimes we take nature for an aggregate of powers belonging to a body, efpecially a living one; in which fenfe phyficians fay, that nature is ftrong, weak, or fpent; or that, in fuch or fuch difeafes, nature left to herfelf will perform the cure. 7. Sometimes we ufe the term *nature* for the univerfe, or whole fyftem of the corporeal works of God; as when it is faid of a phœnix, or chimera, that there is no fuch thing in nature. 8. Sometimes too, and that moft commonly, we exprefs by the word *nature* a kind of femi-deity, or other ftrange kind of being.

If, fays the fame philofopher, I were to propofe a notion of nature, lefs ambiguous than thofe already mentioned, and with regard to which many axioms relating to that word may be conveniently underftood, I fhould firft diftinguifh between the univerfal and the particular nature of things. Univerfal nature I would define to be the aggregate of the bodies that make up the world in its prefent ftate, confidered as a principle; by virtue whereof they act and fuffer, according to the laws of motion prefcribed by the Author of all things. And this makes way for the other fubordinate notion; fince the particular nature of an individual confifts in the general nature applied to a diftinct portion of the univerfe; or, which is the fame thing, it is a particular affemblage of the mechanical properties of matter, as figure, motion, &c.

Kingdoms of Nature. See Kingdoms.

Conduct or Operations of Nature. See *Natural Hiftory*.

NAVA, (anc. geog.) Tacitus; a river of Belgica, which runs north-eaft into the left or weft fide of the Rhine. Now the *Nahe*, rifing at the village Naheweiler, on the borders of the bifhopric of Triers, running through the Lower Palatinate, the duchy of Simmeren, by the fmall town of Bing, into the Rhine.

NAVAL, fomething relating to a fhip; whence,

Naval Architecture. See *Ship-Building*.

Naval-Camp, in antiquity, a fortification, confifting of a ditch and parapet on the land fide, or a wall built in the form of a femicircle, and extended from one point of the fea to another. This was fometimes defended with towers, and beautified with gates, through which they iffued forth to attack their enemies. Homer hath left us a remarkable defcription of the Grecian fortifications of this fort, in the Trojan war, beginning at v. 436. Iliad η.

Then, to fecure the camp and naval powers,
They rais'd embattled walls with lofty tow'rs:
From fpace to fpace were ample gates around,
For paffing chariots; and a trench profound,
Of large extent; and deep in earth below
Strong piles infix'd ftood adverfe to the foe.

Pope's *Tranfl.*

Towards the fea, or within it, they fixed great pales of wood, like thofe in their artificial harbours; before thefe the veffels of burden were placed in fuch order, as that they might be inftead of a wall, and give protection to thofe within; in which manner Nicias is reported by Thucydides to have encamped himfelf: but this feems only to have been practifed when the enemy was thought fuperior in ftrength, and raifed great apprehenfions of danger in them. When their fortifications were thought ftrong enough to defend them from the affaults of enemies, it was frequent to drag their fhips to fhore, which the Greeks called ἐνωλκειν, the Romans *fubducere*. Around the fhips the foldiers difpofed their tents, as appears every where in Homer: but this feems only to have been practifed in winter, when their enemy's fleet was laid up and could not affault them; or in long fieges, and when they lay in no danger from their enemies by fea;

as in the Trojan war, where the defenders of Troy never once attempted to encounter the Grecians in a sea-fight.

The adjacent places were usually filled with inns and stews, well stocked with females, that prostituted themselves to the mariners, merchants, and artificers of all sorts, who flocked thither in great numbers; this, however, appears to have happened only in times of peace.

Naval-Crown, among the ancient Romans, a crown adorned with figures of prows of ships, conferred on persons who in sea-engagements first boarded the enemy's vessel. See Crown.

Naval-Engagement. See Tactics *(Naval)*.

Naval Stores, comprehend all those particulars made use of, not only in the royal navy, but in every other kind of navigation; as timber and iron for shipping, pitch, tar, hemp, cordage, sail-cloth, gunpowder, ordnance, and fire-arms of every sort, ship-chandlery wares, &c.

Naval-Tactics, the military operations of fleets. See Tactics *(Naval)*.

NAVAN, a borough, post, and fair town of Ireland, in the county of Meath and province of Leinster; situated about 23 miles north-west of Dublin, on the river Boyne. It consists of two chief streets, which intersect each other at right angles.—The Tholsel, or town-house, is a handsome stone-building. This place was formerly in great repute, and walled in by Hugh de Lacy. An abbey for regular cannons, dedicated to the Virgin Mary, was erected here; but whether antecedent to the end of the 12th century is not certain: about that period, however, it was either founded or re-edified by Joceline de Angulo or Nangle. In the burial-ground are the remains of many ancient tombs, with figures in alto relievo; and the present barrack for one troop of horse is built on the site of the abbey. Navan sends two members to parliament; patronage in the Preston family. Here are four fairs held.

NAVARRE, a province of Spain, part of the ancient kingdom of Navarre, erected soon after the invasion of the Moors; and is otherwise called *Upper Navarre*, to distinguish it from Lower Navarre belonging to the French. It is bounded on the south and east by Arragon, on the north by the Pyrenees, and on the west by Old Castile and Biscay; extending from south to north about 80 miles, and from east to west about 75. It abounds in sheep and cattle; game of all kinds, as boars, stags, and roebucks; and in wild-fowl, horses, and honey; yielding also some grain, wine, oil, and a variety of minerals, medicinal waters, and hot baths. Some of the ancient chiefs of this country were called *Sobrarbores*, from the custom, as it is supposed, which prevailed among some of those free nations of choosing and swearing their princes under some particular tree. The name of the province is supposed to be a contraction of *Nava Errea*, signifying, in the language of the Vascones, its ancient inhabitants, "a land of valleys."—For the particulars of its history, see the article Spain.

Navarre (Peter), an officer of eminence in the 16th century, and particularly celebrated for his dexterity in the directing and springing of mines. He was a native of Biscay, and of low extraction. According to Paul Jove, who affirms that he had an account of the matter from his own mouth, he was first a sailor; but being disgusted with that employment, he sought his fortune in Italy, when poverty compelled him to become footman to the cardinal of Arragon. He afterwards inlisted himself a soldier in the Houstine army; and having served there for some time, went to sea again, and distinguished himself by his courage. The reputation of his valour having reached the ears of Gonsalvo de Cordoue, this general employed him in the war against Naples, and raised him to the rank of a captain. Having contributed greatly to the taking of that city by very opportunely springing a mine, the emperor rewarded him for this signal service with the earldom of Alveto, situated in that kingdom, and gave him the title of *count of Navarre*. Having the command of a naval expedition against the Moors in Africa, he was at first very successful, and took possession of Oran, Tripoli, and some other places; but being afterwards shipwrecked on the island of Gerbes, the great heats and the Moorish cavalry destroyed a part of his army. Our hero was equally unfortunate in Italy: He was made prisoner at the famous battle of Ravenna, in 1512, and languished in France for the space of two years. When finding that the king of Spain, who had been prejudiced against him by his courtiers, would do nothing towards his ransom, he went into the service of Francis I. who gave him the command of twenty companies of infantry, consisting of Gascons, Biscayans, and the inhabitants of the Pyrenee mountains. He distinguished himself in several successful expeditions, until the year 1522, when having been sent to the relief of the Genoese, he was taken by the Imperialists. They conducted him to Naples, where he remained a prisoner for three years in the castle of Œuf. From this confinement he was released by the treaty of Madrid, and afterwards fought at the siege of Naples under Laulric in 1528: but being again made prisoner at the unfortunate retreat from Aversa, he was conducted a second time to the castle of Œuf. Here the prince of Orange having, by order of the emperor, caused several persons of the *Angevine* faction to be beheaded, our hero would undoubtedly have suffered the same fate, if the governor, seeing his distressed situation, and feeling for the misfortunes of so great a man, had not saved him the shame of this last punishment by allowing him to die a natural death. Others pretend that he was strangled in his bed, having arrived at a very advanced age. Paul Jove and Philip Thomasini have written his life. This last informs us, that he was of a tall size, had a swarthy countenance, black eyes, beard, and hair. A duke of Sessa, in the last century, being desirous to honour his memory and that of the marshal de Lautree, caused a monument to be erected to each of them in the church of Sainte-Marie-le-Neuve at Naples, where they had been interred without any funeral honours.

Navarre (surnamed Martin Azpilcucta), because he was born in the kingdom which bears that name, successively professor of jurisprudence at Toulouse, Salamanca, and Coimbra, was consulted from all quarters as the oracle of law. For a part of his knowledge he was indebted to the schools of Cahors and Toulouse,

in which he had ſtudied. His friend Barthelemi Carewza, a Dominican, and archbiſhop of Toledo, having been charged with hereſy by the court of Inquiſition at Rome, Navarre ſet out at the age of 80 years to defend him. Pius V. appointed him aſſeſſor to cardinal Francis Alciat, vice-penetentiary. Gregory XIII. never paſſed his gate without ſending for him; and ſometimes would converſe with him for an hour together on the ſtreet: he even deigned to viſit him, accompanied by ſeveral cardinals. Theſe honours did not render him more haughty. His character became ſo eminent, that even in his own time the greateſt encomium that could be paid to a man of learning was to ſay that he was a *Navarre:* this name thus included the idea of erudition, as that of Roſcius formerly marked an accompliſhed comedian. Azpilcueta was the oracle of the city of Rome, and of the whole Chriſtian world. For the influence which he had acquired, he was indebted not only to his knowledge, but alſo to his probity and virtue. Faithful to the duties which the church preſcribed, his temperance and frugality preſerved to him a vigorous conſtitution; and at a very advanced age his genius was equal to the ſevereſt ſtudy. His ſavings enabled him to give liberal aſſiſtance to the poor. His charities, indeed, were ſo great, that his mule, it is ſaid, would ſtop as ſoon as ſhe perceived a beggar. He died at Rome in 1586, at the age of 92. His works were collected and printed in 6 vols folio at Lyons in 1597, and at Venice in 1602. They diſplay more learning than judgement, and are now very ſeldom conſulted. Navarre was uncle by the mother's ſide to St Francis of Sales. See Sales.

NAUCLERUS (John), deſcended of a noble family of Suabia, was provoſt of the church of Suringia, and profeſſor of law in the univerſity of that city.—His original name was *Vergeau;* but this name, which in German ſignifies "ſailor," he changed into Nauclerus, a word of the ſame ſignification in Greek.—He was alive in 1501. We have from him a Latin Chronicle from Adam to the year 1500, of which Baſelius wrote a continuation down to 1514, and Surius to 1564. It poſſeſſes greater accuracy than any hiſtorical compilation which had appeared prior to his time; but ſtill it is only a compilation. It is chiefly valued for what regards the occurrences of the 15th century. It was printed at Cologne in folio in 1564 and 1579.

NAUCRARI, among the Athenians, was the name given to the chief magiſtrates of the Δημοι, "boroughs or townſhips," called Ναυκραριαι; becauſe each was obliged, beſides two horſemen, to furniſh out one ſhip for the public ſervice.

NAUCRATES, a Greek poet, who was employed by Artemiſia to write a panegyric upon Mauſolus.—An orator who endeavoured to alienate the cities of Lycia from the intereſt of Brutus.

NAUCRATIS, a city of Egypt on the left ſide of the Canopic mouth of the Nile. It was celebrated for its commerce, and no ſhip was permitted to land at any other place, but was obliged to ſail directly to the city, there to depoſit its cargo. It gave birth to Athenæus.

NAUCRATITES Nomos (anc. geog.), Pliny; a diviſion of the Delta, ſo called from the town *Naucratis;* though Ptolemy compriſes it under the Nomos Saites.

NAUCYDES, a ſtatuary who lived about four centuries before the Chriſtian era.

NAUDE (Gabriel), was deſcended of a reputable family, and born at Paris, February 12th, 1600.—His parents obſerving his fondneſs for reading and inclination to letters, reſolved to breed him in that way; and accordingly ſent him to a religious community, to learn the firſt rudiments of grammar and the principles of Chriſtianity. Thence he was removed to the univerſity, where he applied himſelf with great ſucceſs to claſſical learning; and having learned philoſophy, was created maſter of arts very young.—As ſoon as he had finiſhed his courſe in philoſophy, he remained ſome time at a ſtand what profeſſion to chooſe, being adviſed by his friends to divinity; but his inclination being more turned to phyſic, he fixed at length upon that faculty. However, this choice did not prevent him from indulging his genius in other branches of learning: in reality, the plan of his ſtudies was very extenſive, ſuited to his comprehenſive talents and indefatigable induſtry: and he ſoon diſtinguiſhed himſelf therein ſo much, that Henry de Meſmes, preſident à mortier, hearing his character, made him keeper of his library, and took him into his family. Naude was the more pleaſed with this poſt, as it gave him an opportunity of gratifying his bookiſh taſte in general, and at the ſame time furniſhed him both with means and leiſure to improve himſelf as he could wiſh, in the ſcience which he had embraced in particular. He quitted it in 1626, in order to go to Padua to perfect himſelf therein: but he did not continue long in that univerſity, the death of his father and his domeſtic affairs calling him back to Paris before the expiration of the year.

In 1628 the faculty of phyſic appointed him to make the cuſtomary diſcourſe on the reception of licentiates; which performance entirely anſwered their expectations from him, and was made public. In 1631, Cardinal Bagni made him his librarian and Latin ſecretary, and carried him with him to Rome in the ſpring of that year. Naude continued in this ſervice till the death of the cardinal, which happened July 24. 1641; and in the interim made an excurſion to Padua, to take his doctor of phyſic's degree in order to ſupport with a better grace the quality with which he had been honoured by Louis XIII. who had made him his phyſician. The ceremony of this appointment was performed March 25. 1633, and we have the ſpeech he pronounced on the occaſion. After the death of his patron, he had thoughts of returning to France; but was detained in Italy by ſeveral advantageous offers made to him by perſons of conſideration in that country. Among theſe he preferred thoſe of Cardinal Barberini, and cloſed with his eminence. However, as ſoon as Cardinal Richelieu ſent for him to be his librarian, he immediately returned to Paris; but he happened not to be long in the ſervice of the prime miniſter, if it be true that he arrived at Paris in March 1642, ſince Cardinal Richelieu died in December following: notwithſtanding, he ſucceeded to the like poſt under Mazarine, for whom he

formed a moſt rich library, which he raiſed from the firſt volume in the ſpace of ſeven years to the number of 40,000.

His deſign was nearly completed before the Cardinal gave him two ſmall benefices, a canonry of Verdun and the priory of Artige in the Limoſin: and we know how much this ungeneroſity affected him, from a letter of Patin to Charles Spon, dated March 22. 1648, where he writes thus of our librarian: "I have ſeen one thing in him which I am very ſorry for; eſpecially as I have known him all along hitherto at a great diſtance from ſuch a diſpoſition: it is, that he begins to complain of his fortune, and of his maſter's avarice, from whom he had never received any more than 1200 livres a year in benefices; not forbearing to declare, that his life was ſacrificed for too ſmall a matter. I think (continues Patin) what grieves him is, the apprehenſion of dying before he has raiſed ſomething for his brothers and his nephews, of whom he has a great number." However that be, Naude had the grief to ſee this library, which he had collected with ſo much pains and care, totally diſperſed. Upon the diſgrace of Mazarine it was ſold; and Patin, in a letter of March 5. 1651, obſerves, that Naude had bought all the books in phyſic for 3500 livres Chriſtina queen of Sweden, who ſet herſelf to draw into her dominions all the literati of Europe, procured a propoſal to be made to Naude of being her library keeper; and as he was then out of all employ, he accepted the propoſal, and went to Cop.—But he ſoon grew out of humour with his reſidence in Sweden: the manners of the people, ſo very different from his, gave him great diſguſt; and ſeeing France become more quiet than it had been, he reſolved to return. Accordingly he quitted Sweden loaded with preſents from the queen, and ſeveral perſons of diſtinction: but the fatigue of the journey threw him into a fever, which obliged him to ſtop at Abbeville; and he died there July 29. 1653.

As to his character, he was very prudent and regular in his conduct, ſober, never drinking any thing but water. Study was his principal occupation, and he was indeed a true *Helluo librorum;* ſo that he underſtood them perfectly well. He ſpoke his mind with great freedom, and that freedom ſometimes ſhowed itſelf upon religious ſubjects, in ſuch a manner as might have occaſioned ſome diſadvantageous thoughts of him; but the Chriſtian ſentiments in which he died left room to believe that his heart was never corrupted, and had no ſhare in the free expreſſions which ſometimes eſcaped from him; eſpecially in the philoſophical railleries which paſſed ſometimes between him, Guy Patin, and Gaſſendi. He wrote a great number of books, a catalogue of which may be ſeen in Niceron's Memoires, tom. ix. Voltaire ſays, that "of all his books, the *Apologie des grands Hommes accuſés de Magie* is almoſt the only one which continues to be read."

NAVE, in architecture, the body of a church, where the people are diſpoſed, reaching from the balluſter, or rail of the door, to the chief choir. Some derive the word from the Greek ναος, "a temple;" and others from ναυς, "a ſhip," by reaſon the vault or roof of a church bears ſome reſemblance to a ſhip.

NAVEL, in anatomy, the centre of the lower part of the abdomen; being that part where the umbilical veſſels paſſed out of the placenta of the mother. See ANATOMY, p. 725.

NAVEL-Wort, in botany. See COTYLEDON.

NAVEW, in botany. See BRASSICA, of which it is a ſpecies.

NAVIGATION,

IS the art of conducting or carrying a ſhip from one port to another.

HISTORY.

THE poets refer the invention of the art of navigation to Neptune, ſome to Bacchus, others to Hercules, others to Jaſon, and others to Janus, who is ſaid to have made the firſt ſhip. Hiſtorians aſcribe it to the Æginets, the Phœnicians, Tyrians, and the ancient inhabitants of Britain. Some will have it, the firſt hint was taken from the flight of the kite; others, as Oppian, (*De piſcibus*, lib. i.) from the fiſh called *nautilus:* others aſcribe it to accident.—Scripture refers the origin of ſo uſeful an invention to God himſelf, who gave the firſt ſpecimen thereof in the ark built by Noah under his direction. For the raillery the good man underwent on account of his enterpriſe ſhows evidently enough the world was then ignorant of any thing like navigation, and that they even thought it impoſſible.

However, profane hiſtory repreſents the Phœnicians, eſpecially thoſe of their capital Tyre, as the firſt navigators; being urged to ſeek a foreign commerce by the narrowneſs and poverty of a ſlip of ground they poſſeſſed along the coaſts; as well as by the conveniency of two or three good ports, and by their natural genius to traffic. Accordingly, Lebanon, and the other neighbouring mountains, furniſhing them with excellent wood for ſhip-building, in a ſhort time they were maſters of a numerous fleet; and conſtantly hazarding new navigations, and ſettling new trades, they ſoon arrived at an incredible pitch of opulency and populouſneſs: inſomuch as to be in a condition to ſend out colonies, the principal of which was that of Carthage; which, keeping up their Phœnician ſpirit of commerce, in time not only equalled Tyre itſelf, but vaſtly ſurpaſſed it; ſending its merchant-fleets through Hercules's pillars, now the ſtraits of Gibraltar, along the weſtern coaſts of Africa and Europe; and even, if we believe ſome authors, to America itſelf.

Tyre, whoſe immenſe riches and power are repreſented in ſuch lofty terms both in ſacred and profane authors, being deſtroyed by Alexander the Great, its navigation and commerce were transferred by the conqueror to Alexandria, a new city, admirably ſituated for thoſe purpoſes; propoſed for the capital of the empire of Aſia, which Alexander then meditated.

And

And thus arofe the navigation of the Egyptians; which was afterwards fo cultivated by the Ptolemies, that Tyre and Carthage were quite forgotten.

Egypt being reduced into a Roman province after the battle of Actium, its trade and navigation fell into the hands of Auguftus; in whofe time Alexandria was only inferior to Rome: and the magazines of the capital of the world were wholly fupplied with merchandizes from the capital of Egypt.

At length, Alexandria itfelf underwent the fate of Tyre and Carthage; being furprifed by the Saracens, who, in fpite of the emperor Heraclius, overfpread the northern coafts of Africa, &c. whence the merchants being driven, Alexandria has ever fince been in a languifhing ftate, though it ftill has a confiderable part of the commerce of the Chriftian merchants trading to the Levant.

The fall of Rome and its empire drew along with it not only that of learning and the polite arts, but that of navigation; the barbarians, into whofe hands it fell, contenting themfelves with the fpoils of the induftry of their predeceffors.

But no fooner were the more brave among thofe nations well fettled in their new provinces; fome in Gaul, as the Franks; others in Spain, as the Goths; and others in Italy, as the Lombards; but they began to learn the advantages of navigation and commerce, and the methods of managing them, from the people they fubdued; and this with fo much fuccefs, that in a little time fome of them became able to give new leffons, and fet on foot new inftitutions for its advantage. Thus it is to the Lombards we ufually afcribe the invention and ufe of banks, book-keeping, exchanges, rechanges, &c.

It does not appear which of the European people, after the fettlement of their new mafters, firft betook themfelves to navigation and commerce.—Some think it began with the French; though the Italians feem to have the jufteft title to it; and are accordingly ordinarily looked on as the reftorers thereof, as well as of the polite arts, which had been banifhed together from the time the empire was torn afunder. It is the people of Italy then, and particularly thofe of Venice and Genoa, who have the glory of this reftoration; and it is to their advantageous fituation for navigation they in great meafure owe their glory. In the bottom of the Adriatic were a great number of marfhy iflands, only feparated by narrow channels, but thofe well fcreened, and almoft inacceffible, the refidence of fome fifhermen, who here fupported themfelves by a little trade of fifh and falt, which they found in fome of thefe iflands. Thither the Veneti, a people inhabiting that part of Italy along the coafts of the gulph, retired, when Alaric king of the Goths, and afterwards Attila king of the Huns, ravaged Italy.

Thefe new iflanders, little imagining that this was to be their fixed refidence, did not think of compofing any body-politic; but each of the 72 iflands of this little Archipelago continued a long time under its feveral mafters, and each made a diftinct commonwealth. When their commerce was become confiderable enough to give jealoufy to their neighbours, they began to think of uniting into a body. And it was this union, firft begun in the fixth century, but not completed till the eighth, that laid the fure foundation of the future grandeur of the ftate of Venice. From the time of this union, their fleets of merchantmen were fent to all the parts of the Mediterranean; and at laft to thofe of Egypt, particularly Cairo, a new city, built by the Saracen princes on the eaftern banks of the Nile, where they traded for their fpices and other products of the Indies. Thus they flourifhed, increafed their commerce, their navigation, and their conquefts on the terra firma, till the league of Cambray in 1508, when a number of jealous princes confpired to their ruin; which was the more eafily effected by the diminution of their Eaft-India commerce, of which the Portuguefe had got one part and the French another. Genoa, which had applied itfelf to navigation at the fame time with Venice, and that with equal fuccefs, was a long time its dangerous rival, difputed with it the empire of the fea, and fhared with it the trade of Egypt and other parts both of the eaft and weft.

Jealoufy foon began to break out; and the two republics coming to blows, there was almoft continual war for three centuries before the fuperiority was afcertained; when, towards the end of the 14th century, the battle of Chioza ended the ftrife; the Genoefe, who till then had ufually the advantage, having now loft all; and the Venetians, almoft become defperate, at one happy blow, beyond all expectation, fecured to themfelves the empire of the fea, and fuperiority in commerce.

About the fame time that navigation was retrieved in the fouthern parts of Europe, a new fociety of merchants was formed in the north, which not only carried commerce to the greateft perfection it was capable of till the difcovery of the Eaft and Weft Indies, but alfo formed a new fcheme of laws for the regulation thereof, which ftill obtain under the names of *Ufes and Cuftoms of the Sea*. This fociety is that famous league of the Hanfe-towns, commonly fuppofed to have begun about the year 1164. See *Hanse Towns*.

For the modern ftate of navigation in England, Holland, France, Spain, Portugal, &c. See Commerce, Company, &c.

We fhall only add, that, in examining the reafons of commerce's paffing fucceffively from the Venetians, Genoefe, and Hanfe-towns, to the Portuguefe and Spaniards, and from thefe again to the Englifh and Dutch, it may be eftablifhed as a maxim, that the relation between commerce and navigation, or, if we may be allowed to fay it, their union is fo intimate, that the fall of the one inevitably draws after it that of the other; and that they will always either flourifh or dwindle together. Hence fo many laws, ordinances, ftatutes, &c. for its regulation; and hence particularly that celebrated act of navigation, which an eminent foreign author calls the *palladium* or *tutelar deity of the commerce of England*; which is the ftanding rule, not only of the Britifh among themfelves, but alfo of other nations with whom they traffic.

The art of navigation hath been exceedingly improved in modern times, both with regard to the form of the veffels themfelves, and with regard to the methods of working them. The ufe of rowers is now entirely fuperfeded by the improvements made in the formation of the fails, rigging, &c. by which means the

the ſhips can not only ſail much faſter than formerly, but can tack in any direction with the greateſt facility. It is alſo very probable that the ancients were neither ſo well ſkilled in finding the latitudes, nor in ſteering their veſſels in places of difficult navigation, as the moderns. But the greateſt advantage which the moderns have over the ancients is from the mariner's compaſs, by which they are enabled to find their way with as great facility in the midſt of an immeaſurable ocean, as the ancients could have done by creeping along the coaſt, and never going out of ſight of land. Some people indeed contend, that this is no new invention, but that the ancients were acquainted with it. They ſay, that it was impoſſible for Solomon to have ſent ſhips to Ophir, Tarſhiſh, and Parvaim, which laſt they will have to be *Peru*, without this uſeful inſtrument. They inſiſt, that it was impoſſible for the ancients to be acquainted with the attractive virtue of the magnet, and to be ignorant of its polarity. Nay, they affirm, that this property of the magnet is plainly mentioned in the book of Job, where the loadſtone is mentioned by the name of *topaz*, or *the ſtone that turns itſelf*. But it is certain, that the Romans, who conquered Judæa, were ignorant of this inſtrument; and it is very improbable, that ſuch an uſeful invention, if once it had been commonly known to any nation, would have been forgot, or perfectly concealed from ſuch a prudent people as the Romans, who were ſo much intereſted in the diſcovery of it.

Among thoſe who do agree that the mariner's compaſs is a modern invention, it hath been much diſputed who was the inventor. Some give the honour of it to Flavio Gioia of Amalfi in Campania*, who lived about the beginning of the 14th century; while others ſay that it came from the eaſt, and was earlier known in Europe. But, at whatever time it was invented, it is certain, that the mariner's compaſs was not commonly uſed in navigation before the year 1420. In that year the ſcience was conſiderably improved under the auſpices of Henry duke of Viſco, brother to the king of Portugal. In the year 1485, Roderic and Joſeph, phyſicians to John II. king of Portugal, together with one Martin de Bohemia, a Portugueſe, native of the iſland of Fayal, and ſcholar to Regiomontanus, calculated tables of the ſun's declination for the uſe of ſailors, and recommended the aſtrolabe for taking obſervations at ſea. Of the inſtructions of Martin, the celebrated Chriſtopher Columbus is ſaid to have availed himſelf, and to have improved the Spaniards in the knowledge of the art; for the farther progreſs of which a lecture was afterwards founded at Seville by the emperor Charles V.

* See *Mariner's Compaſs*.

The diſcovery of the variation is claimed by Columbus, and by Sebaſtian Cabot. The former certainly did obſerve this variation without having heard of it from any other perſon, on the 14th of September 1492, and it is very probable that Cabot might do the ſame. At that time it was found that there was no variation at the Azores, where ſome geographers have thought proper to place the firſt meridian; though it hath ſince been obſerved that the variation alters in time.—The uſe of the croſs-ſtaff now began to be introduced among ſailors. This ancient inſtrument is deſcribed by John Werner of Nuremberg, in his annotations on the firſt book of Ptolemy's Geography, printed in 1514. He recommends it for obſerving the diſtance between the moon and ſome ſtar, in order thence to determine the longitude.

At this time the art of navigation was very imperfect on account of the inaccuracies of the plane chart, which was the only one then known, and which, by its groſs errors, muſt have greatly miſled the mariner, eſpecially in voyages far diſtant from the equator. Its precepts were probably at firſt only ſet down on the ſea-charts, as is the cuſtom at this day: but at length there were two Spaniſh treatiſes publiſhed in 1545; one by Pedro de Medina; the other by Martin Cortes, which contained a complete ſyſtem of the art, as far as it was then known. Theſe ſeem to have been the oldeſt writers who fully handled the art; for Medina, in his dedication to Philip prince of Spain, laments that multitudes of ſhips daily periſhed at ſea, becauſe there were neither teachers of the art, nor books by which it might be learned; and Cortes, in his dedication, boaſts to the emperor, that he was the firſt who had reduced navigation into a compendium, valuing himſelf much on what he had performed. Medina defended the plane chart; but he was oppoſed by Cortes, who ſhowed its errors, and endeavoured to account for the variation of the compaſs, by ſuppoſing the needle to be influenced by a magnetic pole (which he called the *point attractive*) different from that of the world: which notion hath been farther proſecuted by others. Medina's book was ſoon tranſlated into Italian, French, and Flemiſh, and ſerved for a long time as a guide to foreign navigators. However, Cortes was the favourite author of the Engliſh nation, and was tranſlated in 1561; while Medina's work was entirely neglected, though tranſlated alſo within a ſhort time of the other. At that time the ſyſtem of navigation conſiſted of the following particulars, and others ſimilar: An account of the Ptolemaic hypotheſis, and the circles of the ſphere; of the roundneſs of the earth, the longitudes, latitudes, climates, &c. and eclipſes of the luminaries; a kalendar; the method of finding the prime, epact, moon's age, and tides; a deſcription of the compaſs, an account of its variation, for the diſcovering of which Cortes ſaid an inſtrument might eaſily be contrived; tables of the ſun's declination for four years, in order to find the latitude from his meridian altitude; directions to find the ſame by certain ſtars; of the courſe of the ſun and moon; the length of the days; of time and its diviſions; the method of finding the hour of the day and night; and laſtly, a deſcription of the ſea-chart, on which to diſcover where the ſhip is, they made uſe of a ſmall table, that ſhowed, upon an alteration of one degree of the latitude, how many leagues were run in each rhumb, together with the departure from the meridian. Beſides, ſome inſtruments were deſcribed, eſpecially by Cortes; ſuch as one to find the place and declination of the ſun, with the days, and place of the moon; certain dials, the aſtrolabe, and croſs-ſtaff; with a complex machine to diſcover the hour and latitude at once.

About the ſame time were made propoſals for finding the longitude by obſervations of the moon.—In 1530, Gemma Friſius adviſed the keeping of the time by means of ſmall clocks or watches, then, as he ſays, newly invented. He alſo contrived a new ſort of

of crofs ftaff and an inftrument called the *nautical quadrant*; which laft was much praifed by William Cuningham, in his *Aftronomical Glafs*, printed in the year 1559.

In 1537 Pedro Nunez, or Nonius, publifhed a book in the Portuguefe language, to explain a difficulty in navigation propofed to him by the commander Don Martin Alphonfo de Sufa. In this he expofes the errors of the plane chart, and likewife gives the folution of feveral curious aftronomical problems; amongft which is that of determining the latitude from two obfervations of the fun's altitude and intermediate azimuth being given. He obferved, that though the rhumbs are fpiral lines, yet the direct courfe of a fhip will always be in the arch of a great circle, whereby the angle with the meridians will continually change: all that the fteerfman can here do for the preferving of the original rhumb, is to correct thefe deviations as foon as they appear fenfible. But thus the fhip will in reality defcribe a courfe without the rhumb-line intended; and therefore his calculations for affigning the latitude, where any rhumb-line croffes the feveral meridians, will be in fome meafure erroneous. He invented a method of dividing a quadrant by means of concentric circles, which, after being much improved by Dr Halley, is ufed at prefent, and is called a *nonius*.

In 1577, Mr William Bourne publifhed a treatife, in which, by confidering the irregularities in the moon's motion, he fhows the errors of the failors in finding her age by the epact, and alfo in determining the hour from obferving on what point of the compafs the fun and moon appeared. He advifes, in failing towards the high latitudes, to keep the reckoning by the globe, as there the plane chart is moft erroneous. He defpairs of our ever being able to find the longitude, unlefs the variation of the compafs fhould be occafioned by fome fuch attractive point, as Cortes had imagined; of which, however, he doubts: but as he had fhown how to find the variation at all times, he advifes to keep an account of the obfervations, as ufeful for finding the place of the fhip; which advice was profecuted at large by Simon Stevin, in a treatife publifhed at Leyden in 1599; the fubftance of which was the fame year printed at London in Englifh by Mr Edward Wright, intitled the *Haven finding Art*. In this ancient tract alfo is defcribed the way by which our failors eftimate the rate of a fhip in her courfe, by an inftrument called the *log*. This was fo named from the piece of wood or log that floats in the water while the time is reckoned during which the line that is faftened to it is veering out. The author of this contrivance is not known; neither was it taken notice of till 1607, in an Eaft India voyage publifhed by Purchas; but from this time it became famous, and was much taken notice of by almoft all writers on navigation in every country; and it ftill continues to be ufed as at firft, though many attempts have been made to improve it, and contrivances propofed to fupply its place; many of which have fucceeded in quiet water, but proved ufelefs in a ftormy fea.

In 1581 Michael Coignet, a native of Antwerp, publifhed a treatife, in which he animadverted on Medina. In this he fhowed, that as the rhumbs are fpirals, making endlefs revolutions about the poles, numerous errors muft arife from their being reprefented by ftraight lines on the fea-charts; but though he hoped to find a remedy for thefe errors, he was of opinion that the propofals of Nonius were fcarcely practicable, and therefore in a great meafure ufelefs. In treating of the fun's declination, he took notice of the gradual decreafe in the obliquity of the ecliptic; he alfo defcribed the crofs-ftaff with three tranfverfe pieces, as it is at prefent made, and which he owned to have been then in common ufe among the failors. He likewife gave fome inftruments of his own invention; but all of them are now laid afide, excepting perhaps his nocturnal. He conftructed a fea-table to be ufed by fuch as failed beyond the 60th degree of latitude; and at the end of the book is delivered a method of failing on a parallel of latitude by means of a ring dial and a 24 hour-glafs. The fame year the difcovery of the dipping-needle was made by Mr Robert Norman*. In his publication on that art he maintains, in oppofition to Cortes, that the variation of the compafs was caufed by fome point on the furface of the earth, and not in the heavens: he alfo made confiderable improvements in the conftruction of compaffes themfelves; fhowing efpecially the danger of not fixing, on account of the variation, the wire directly under the *flower-de-luce*; as compaffes made in different countries have it placed differently. To this performance of Norman's is always prefixed a difcourfe on the variation of the magnetical needle, by Mr William Burrough, in which he fhows how to determine the variation in many different ways. He alfo points out many errors in the practice of navigation at that time, and fpeaks in very fevere terms concerning thofe who had publifhed upon it.

* See *Dipping-needle*.

All this time the Spaniards continued to publifh treatifes on the art. In 1585 an excellent compendium was publifhed by Roderico Zamorano; which contributed greatly towards the improvement of the art, particularly in the fea charts. Globes of an improved kind, and of a much larger fize than thofe formerly ufed, were now conftructed, and many improvements were made in other inftruments; however, the plane chart continued ftill to be followed, though its errors were frequently complained of. Methods of removing thefe errors had indeed been fought after; and Gerard Mercator feems to have been the firft who found the true method of doing this fo as to anfwer the purpofes of feamen. His method was to reprefent the parallels both of latitude and longitude by parallel ftraight lines, but gradually to augment the former as they approached the pole. Thus the rhumbs, which otherwife ought to have been curves, were now alfo extended into ftraight lines; and thus a ftraight line drawn between any two places marked upon the chart would make an angle with the meridians, expreffing the rhumb leading from the one to the other. But though, in 1569, Mercator publifhed an univerfal map conftructed in this manner, it doth not appear that he was acquainted with the principles on which this proceeded; and it is now generally believed, that the true principles on which the conftruction of what is called *Mercator's chart* depends, were firft difcovered by an Englifhman, Mr Edward Wright.

Mr Wright fuppofes, but, according to the general opinion, without fufficient grounds, that this enlargement of the degrees of latitude was known and mentioned by Ptolemy, and that the fame thing had alfo been fpoken of by Cortes. The expreffions of Ptolemy,

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lemy alluded to, relate indeed to the proportion between the diftances of the parallels and meridians; but inftead of propofing any gradual enlargement of the parallels of latitude, in a general chart, he fpeaks only of particular maps; and advifes not to confine a fyftem of fuch maps to one and the fame fcale, but to plan them out by a different meafure, as occafion might require: only with this precaution, that the degrees of longitude in each fhould bear fome proportion to thofe of latitude; and this proportion is to be deduced from that which the magnitude of the refpective parallels bear to a great circle of the fphere. He adds, that in particular maps, if this proportion be obferved with regard to the middle parallel, the inconvenience will not be great though the meridians fhould be ftraight lines parallel to each other. Here he is faid only to mean, that the maps fhould in fome meafure reprefent the figures of the countries for which they are drawn. In this fenfe Mercator, who drew maps for Ptolemy's tables, underftood him; thinking it, however, an improvement not to regulate the meridians by one parallel, but by two; one diftant from the northern, the other from the fouthern extremity of the map by a fourth part of the whole depth; by which means, in his maps, though the meridians are ftraight lines, yet they are generally drawn inclining to each other towards the poles. With regard to Cortes, he fpeaks only of the number of degrees of latitude, and not of the extent of them; nay, he gives exprefs directions that they fhould all be laid down by equal meafurement on a fcale of leagues adapted to the map.

For fome time after the appearance of Mercator's map, it was not rightly underftood, and it was even thought to be entirely ufelefs, if not detrimental.—However, about the year 1592, its utility began to be perceived; and feven years after, Mr Wright printed his famous treatife entitled, *The Correction of certain Errors in Navigation*, where he fully explained the reafon of extending the length of the parallels of latitude, and the ufes of it to navigators. In 1610, a fecond edition of Mr Wright's book was publifhed with improvements. An excellent method was propofed of determining the magnitude of the earth; at the fame time it was judicioufly propofed to make our common meafures in fome proportion to a degree on its furface, that they might not depend on the uncertain length of a barley-corn. Some of his other improvements were, "The table of latitudes for dividing the meridian computed to minutes;" whereas it had only been divided to every tenth minute. He alfo publifhed a defcription of an inftrument which he calls the *fea-rings*; and by which the variation of the compafs, altitude of the fun, and time of the day, may be determined readily at once in any place, provided the latitude is known. He fhowed alfo how to correct the errors arifing from the eccentricity of the eye in obferving by the crofs-ftaff. He made a total amendment in the tables of the declinations and places of the fun and ftars from his own obfervations made with a fix-foot quadrant in the years 1594, 95, 96, and 97. A fea-quadrant to take altitudes by a forward or backward obfervation; and likewife with a contrivance for the ready finding the latitude by the height of the pole-ftar, when not upon the meridian. To this edition was fubjoined a tranflation of Zamorano's Compendium above mentioned, in which he corrected fome miftakes in the original; adding a large table of the variation of the compafs obferved in very different parts of the world, to fhow that it was not occafioned by any magnetical pole.

Thefe improvements foon became known abroad.—In 1608, a treatife intitled, *Hypomnemata Mathematica*, was publifhed by Simon Stevin, for the ufe of Prince Maurice. In that part relating to navigation, the author having treated of failing on a great circle, and fhown how to draw the rhumbs on a globe mechanically, fets down Wright's two tables of latitudes and of rhumbs, in order to defcribe thefe lines more accurately, pretending even to have difcovered an error in Wright's table. But all Stevin's objections were fully anfwered by the author himfelf, who fhowed that they arofe from the grofs way of calculating made ufe of by the former.

In 1624, the learned Wellebrordus Snellius, profeffor of mathematics at Leyden, publifhed a treatife of navigation on Wright's plan, but fomewhat obfcurely; and as he did not particularly mention all the difcoveries of Wright, the latter was thought by fome to have taken the hint of all his difcoveries from Snellius. But this fuppofition is long ago refuted; and Wright enjoys the honour of thofe difcoveries which is juftly his due.

Mr Wright having fhown how to find the place of the fhip on his chart, obferved that the fame might be performed more accurately by calculation: but confidering, as he fays, that the latitudes, and efpecially the courfes at fea, could not be determined fo precifely, he forbore fetting down particular examples; as the mariner may be allowed to fave himfelf this trouble, and only mark out upon his chart the fhip's way, after the manner then ufually practifed. However, in 1614, Mr Raphe Handfon, among his nautical queftions fubjoined to a tranflation of Pitifcus's trigonometry, folved very diftinctly every cafe of navigation, by applying arithmetical calculations to Wright's table of latitudes, or of meridional parts, as it hath fince been called. Though the method difcovered by Wright for finding the change of longitude by a fhip failing on a rhumb is the proper way of performing it, Handfon alfo propofes two ways of approximation to it without the affiftance of Wright's divifion of the meridian line. The firft was computed by the arithmetical mean between the cofines of both latitudes; the other by the fame mean between the fecants as an alternative, when Wright's book was not at hand; though this latter is wider from the truth than the firft. By the fame calculations alfo he fhowed how much each of thefe compendiums deviates from the truth, and alfo how widely the computations on the erroneous principles of the plane chart differ from them all. The method, however, commonly ufed by our failors is commonly called the *middle latitude*; which, though it errs more than that by the arithmetical mean between the two co-fines, is preferred on account of its being lefs operofe: yet in high latitudes it is more eligible to ufe that of the arithmetical mean between the logarithmic co-fines, equivalent to the geometrical mean between the co-fines themfelves; a method fince propofed by Mr John Baffat. The computation by the middle latitude will always fall fhort of the true change of longitude; that by the geometrical mean will always

ways exceed; but that by the arithmetical mean falls ſhort in latitudes above 45 degrees, and exceeds in leſſer latitudes. However, none of theſe methods will differ much from the truth when the change of latitude is ſufficiently ſmall.

About this time logarithms were invented by John Napier, baron of Merchiſton in Scotland, and proved of the utmoſt ſervice to the art of navigation. From which Mr Edmund Gunter conſtructed a table of logarithmic ſines and tangents to every minute of the quadrant, which he publiſhed in 1620. In this work he applied to navigation, and other branches of mathematics, his admirable ruler known by the name of Gunter's ſcale *; on which are deſcribed lines of logarithms, of logarithmic ſines and tangents, of meridional parts, &c. He greatly improved the ſector for the ſame purpoſes. He ſhowed alſo how to take a back obſervation by the croſs-ſtaff, whereby the error ariſing from the eccentricity of the eye is avoided. He deſcribed likewiſe another inſtrument, of his own invention, called the *croſs bow*, for taking altitudes of the ſun or ſtars, with ſome contrivances for the more ready collecting the latitude from the obſervation. The diſcoveries concerning logarithms were carried to France in 1624 by Mr Edmund Wingate, who publiſhed two ſmall tracts in that year at Paris. In one of theſe he taught the uſe of Gunter's ſcale; and in the other, of the tables of artificial ſines and tangents, as modelled according to Napier's laſt form, erroneouſly attributed by Wingate to Briggs.

* See *Gunter's Scale*.

Gunter's rule was projected into a circular arch by the Reverend Mr William Oughtred in 1633, and its uſes fully ſhown in a pamphlet intitled, *The Circles of Proportion*, where, in an appendix, are well treated ſeveral important points in navigation. It has alſo been made in the form of a ſliding ruler.

The logarithmic tables were firſt applied to the different caſes of ſailing by Mr Thomas Addiſon, in his treatiſe intitled, *Arithmetical navigation*, printed in 1625. He alſo gives two traverſe tables, with their uſes; the one to quarter points of the compaſs, the other to degrees. Mr Henry Gellibrand publiſhed his diſcovery of the changes of the variation of the compaſs, in a ſmall quarto pamphlet, intitled, *A diſcourſe mathematical on the variation of the magnetical needle*, printed in 1635. This extraordinary phenomenon he found out by comparing the obſervations made at different times near the ſame place by Mr Burrough, Mr Gunter, and himſelf, all perſons of great ſkill and experience in theſe matters. This diſcovery was likewiſe ſoon known abroad; for Father Athanaſius Kircher, in his treatiſe intitled, *Magnes*, firſt printed at Rome in 1641, informs us, that he had been told it by Mr John Greaves; and then gives a letter of the famous Marinus Merſennus, containing a very diſtinct account of the ſame.

As altitudes of the ſun are taken on ſhipboard by obſerving his elevation above the viſible horizon, to obtain from thence the ſun's true altitude with correctneſs, Wright obſerves it to be neceſſary that the dip of the viſible horizon below the horizontal plane paſſing through the obſerver's eye ſhould be brought into the account, which cannot be calculated without knowing the magnitude of the earth. Hence he was induced to propoſe different methods for finding this; but complains that the moſt effectual was out of his power to execute; and therefore contented himſelf with a rude attempt, in ſome meaſure ſufficient for his purpoſe: and the dimenſions of the earth deduced by him correſponded very well with the uſual diviſions of the log-line; however, as he wrote not an expreſs treatiſe on navigation, but only for the correcting ſuch errors as prevailed in general practice, the log-line did not fail under his notice. Mr Richard Norwood, however, put in execution the method recommended by Mr Wright as the moſt perfect for meaſuring the dimenſions of the earth, with the true length of the degrees of a great circle upon it; and, in 1635, he actually meaſured the diſtance between London and York; from whence, and the ſummer ſolſtitial altitudes of the ſun obſerved on the meridian at both places, he found a degree on a great circle of the earth to contain 367,196 Engliſh feet, equal to 57,300 French fathoms or tortoiſes: which is very exact, as appears from many meaſures that have been made ſince that time. Of all this Mr Norwood gave a full account in his treatiſe called *The Seaman's Practice*, publiſhed in 1637. He there ſhows the reaſon why Snellius had failed in his attempt: he points out alſo various uſes of his diſcovery, particularly for correcting the groſs errors hitherto committed in the diviſions of the log-line. But neceſſary amendments have been little attended to by ſailors, whoſe obſtinacy in adhering to eſtabliſhed errors has been complained of by the beſt writers on navigation. This improvement has at length, however, made its way into practice, and few navigators of reputation now make uſe of the old meaſure of 42 feet to a knot. In that treatiſe alſo Mr Norwood deſcribes his own excellent method of ſetting down and perfecting a ſea-reckoning, by uſing a traverſe table; which method he had followed and taught for many years. He ſhows alſo how to rectify the courſe by the variation of the compaſs being conſidered; as alſo how to diſcover currents, and to make proper allowance on their account. This treatiſe, and another on trigonometry, were continually reprinted, as the principal books for learning ſcientifically the art of navigation. What he had delivered, eſpecially in the latter of them, concerning this ſubject, was contracted as a manual for ſailors, in a very ſmall piece called his *Epitome*; which uſeful performance has gone through a great number of editions. No alterations were ever made in the Seaman's Practice till the 12th edition in 1676, when the following paragraph was inſerted in a ſmaller character: "About the year 1672, Monſieur Picart has publiſhed an account in French, concerning the meaſure of the earth, a breviate whereof may be ſeen in the Philoſophical Tranſactions, N° 112. wherein he concludes one degree to contain 365,184 Engliſh feet, nearly agreeing with Mr Norwood's experiment;" and this advertiſement is continued through the ſubſequent editions as late as the year 1732.

About the year 1645, Mr Bond publiſhed in Norwood's epitome a very great improvement in Wright's method by a property in his meridian line, whereby its diviſions are more ſcientifically aſſigned than the author himſelf was able to effect; which was from this theorem, that theſe diviſions are analogous to the exceſſes of the logarithmic tangents of half the reſpective latitudes augmented by 45 degrees above the logarithm of the radius.

dius. This he afterwards explained more fully in the third edition of Gunter's works, printed in 1653; where, after obferving that the logarithmic tangents from 45° upwards increafe in the fame manner that the fecants added together do, if every half degree be accounted as a whole degree of Mercator's meridional line. His rule for computing the meridional parts belonging to any two latitudes, fuppofed on the fame fide of the equator, is to the following effect: "Take the logarithmic tangent, rejecting the radius, of half each latitude, augmented by 45 degrees; divide the difference of thofe numbers by the logarithmic tangent of 45° 30′, the radius being likewife rejected; and the quotient will be the meridional parts required, expreffed in degrees." This rule is the immediate confequence from the general theorem, That the degrees of latitude bear to one degree (or 60 minutes, which in Wright's table ftands for the meridional parts of one degree), the fame proportion as the logarithmic tangent of half any latitude augmented by 45 degrees, and the radius neglected, to the like tangent of half a degree augmented by 45 degrees, with the radius likewife rejected. But here was farther wanting the demonftration of this general theorem, which was at length fupplied by Mr James Gregory of Aberdeen in his *Exercitationes Geometricæ*, printed at London in 1668; and afterwards more concifely demonftrated, together with a fcientific determination of the divifor, by Dr Halley in the Philofophical Tranfactions for 1695, N° 219. from the confideration of the fpirals into which the rhumbs are transformed in the ftereographic projection of the fphere upon the plane of the equinoctial; and which is rendered ftill more fimple by Mr Roger Cotes, in his Logometria, firft publifhed in the Philofophical Tranfactions for 1714, N° 388. It is moreover added in Gunter's book, that if $\frac{1}{10}$th of this divifion, which does not fenfibly differ from the logarithmic tangent of 45° 1′ 30″ (with the radius fubtracted from it), be ufed, the quotient will exhibit the meridional parts expreffed in leagues: and this is the divifor fet down in Norwood's Epitome. After the fame manner the meridional parts will be found in minutes, if the like logarithmic tangent of 45° 1′ 30″, diminifhed by the radius, be taken; that is, the number ufed by others being 12633, when the logarithmic tables confift of eight places of figures befides the index.

In an edition of the Seaman's Kalendar, Mr Bond declared, that he had difcovered the longitude by having found out the true theory of the magnetic variation; and to gain credit to his affertion, he foretold, that at London in 1657 there would be no variation of the compafs, and from that time it would gradually increafe the other way; which happened accordingly. Again, in the Philofophical Tranfactions for 1668, N° 40. he publifhed a table of the variation for 49 years to come. Thus he acquired fuch reputation, that his treatife, intitled, *The Longitude Found*, was in 1676 publifhed by the fpecial command of Charles II. and approved by many celebrated mathematicians. It was not long, however, before it met with oppofition; and in 1678 another treatife, intitled, *The Longitude not Found*, made its appearance; and as Mr Bond's hypothefis did not in any manner anfwer its author's fanguine expectations, the affair was undertaken by Dr Halley. The refult of his fpeculation was, that the magnetic needle is influenced by four poles; but this wonderful phenomenon feems hitherto to have eluded all our refearches. In 1700, however, Dr Halley publifhed a general map, with curve lines expreffing the paths where the magnetic needle had the fame variation; which was received with univerfal applaufe. But as the pofitions of thefe curves vary from time to time, they fhould frequently be corrected by fkilful perfons; as was done in 1744 and 1756, by Mr William Mountaine, and Mr James Dodfon, F. R. S. In the Philofophical Tranfactions for 1690, Dr Halley alfo gave a differtation on the monfoons; containing many very ufeful obfervations for fuch as fail to places fubject to thefe winds.

After the true principles of the art were fettled by Wright, Bond, and Norwood, the authors on navigation became fo numerous, that it would be impoffible to enumerate them. New improvements were daily made, and every thing relative to it was fettled with an accuracy not only unknown to former ages, but which would have been reckoned utterly impoffible. The earth being found to be a fpheroid, and not a perfect fphere, with the fhorteft diameter paffing thro' the poles, a tract was publifhed in 1741 by the Rev. Doctor Patrick Murdoch, wherein he accommodated Wright's failing to fuch a figure; and Mr Colin Maclaurin, the fame year, in the Philofophical Tranfactions, N° 461. gave a rule for determining the meridional parts of a fpheroid; which fpeculation is farther treated of in his book of Fluxions, printed at Edinburgh in 1742.

Among the later difcoveries in navigation, that of finding the longitude both by lunar obfervations and by time-keepers is the principal. It is owing chiefly to the rewards offered by the Britifh parliament that this has attained the prefent degree of perfection. We are indebted to Dr Mafkelyne for putting the firft of thefe methods in practice, and for other important improvements in navigation. The time-keepers, conftructed by Harrifon for this exprefs purpofe, were found to anfwer fo well, that he obtained the parliamentary reward.

THEORY OF NAVIGATION.

THE motion of a fhip in the water is well known to depend on the action of the wind upon its fails, regulated by the direction of the helm. As the water is a refifting medium, and the bulk of the fhip very confiderable, it thence follows, that there is always a great refiftance on her fore-part; and when this refiftance becomes fufficient to balance the moving force of the wind upon the fails, the fhip attains her utmoft degree of velocity, and her motion is no longer accelerated. This velocity is different according to the different ftrength of the wind; but the ftronger the wind, the greater refiftance is made to the fhip's paffage through the water: and hence, though the wind fhould blow ever fo ftrong, there is alfo a limit to

to the velocity of the ſhip: for the ſails and ropes can bear but a certain force of air; and when the reſiſtance on the fore-part becomes more than equivalent to their ſtrength, the velocity can be no longer increaſed, and the rigging gives way.

The direction of a ſhip's motion depends on the poſition of her ſails with regard to the wind, combined with the action of the rudder. The moſt natural direction of the ſhip is, when ſhe runs directly before the wind, the ſails are then diſpoſed, ſo as to be at right angles thereto. But this is not always the caſe, both on account of the variable nature of the winds, and the ſituation of the intended port, or of intermediate headlands or iſlands. When the wind therefore happens not to be favourable, the ſails are placed ſo as to make an oblique angle both with the direction of the ſhip and with the wind; and the ſails, together with the rudder, muſt be managed in ſuch a manner, that the direction of the ſhip may make an acute angle with that of the wind; and the ſhip making boards on different tacks, will by this means arrive at the intended port.

The reaſon of the ſhip's motion in this caſe is, that the water reſiſts the ſide more than the fore-part, and that in the ſame proportion as her length exceeds her breadth. This proportion is ſo conſiderable, that the ſhip continually flies off where the reſiſtance is leaſt, and that ſometimes with great ſwiftneſs. In this way of ſailing, however, there is a great limitation: for if the angle made by the keel with the direction of the wind be too acute, the ſhip cannot be kept in that poſition; neither is it poſſible for a large ſhip to make a more acute angle with the wind than about 6 points; though ſmall ſloops, it is ſaid, may make an angle of about 5 points with it. In all theſe caſes, however, the velocity of the ſhip is greatly retarded; and that not only on account of the obliquity of her motion, but by reaſon of what is called her *lee-way*. This is occaſioned by the yielding of the water on the lee-ſide of the ſhip, by which means the veſſel acquires a compound motion, partly in the direction of the wind, and partly in that which is neceſſary for attaining the deſired port.

It is perhaps impoſſible to lay down any mathematical principles on which the lee-way of a ſhip could be properly calculated; only we may ſee in general that it depends on the ſtrength of the wind, the roughneſs of the ſea, and the velocity of the ſhip. When the wind is not very ſtrong, the reſiſtance of the water on the lee-ſide bears a very great proportion to that of the current of air: and therefore it will yield but very little: however, ſuppoſing the ſhip to remain in the ſame place, it is evident, that the water having once begun to yield, will continue to do ſo for ſome time, even though no additional force was applied to it; but as the wind continually applies the ſame force as at firſt, the lee-way of the ſhip muſt go on conſtantly increaſing till the reſiſtance of the water on the lee-ſide balances the force applied on the other, when it will become uniform, as doth the motion of a ſhip ſailing before the wind. If the ſhip changes her place with any degree of velocity, then every time ſhe moves her own length, a new quantity of water is to be put in motion, which hath not yet received any momentum, and which of conſequence will make a greater reſiſtance than it can do when the ſhip remains in the ſame place. In proportion to the ſwiftneſs of the ſhip, then the lee-way will be the leſs: but if the wind is very ſtrong, the velocity of the ſhip bears but a ſmall proportion to that of the current of air; and the ſame effects muſt follow as though the ſhip moved ſlowly, and the wind was gentle; that is, the ſhip muſt make a great deal of lee-way.—The ſame thing happens when the ſea riſes high, whether the wind is ſtrong or not; for then the whole water of the ocean, as far as the ſwell reaches, hath acquired a motion in a certain direction, and that to a very conſiderable depth. The mountainous waves will not fail to carry the ſhip very much out of her courſe; and this deviation will certainly be according to their velocity and magnitude. In all caſes of a rough ſea, therefore, a great deal of lee-way is made.—Another circumſtance alſo makes a variation in the quantity of the lee-way; namely, the lightneſs or heavineſs of the ſhip; it being evident, that when the ſhip ſinks deep in the water, a much greater quantity of that element is to be put in motion before ſhe can make any lee-way, than when ſhe ſwims on the ſurface. As therefore it is impoſſible to calculate all theſe things with mathematical exactneſs, it is plain that the real courſe of a ſhip is exceedingly difficult to be found, and frequent errors muſt be made, which only can be corrected by celeſtial obſervations.

In many places of the ocean there are *currents*, or places where the water, inſtead of remaining at reſt, runs with a very conſiderable velocity for a great way in ſome particular direction, and which will certainly carry the ſhip greatly out of her courſe. This occaſions an error of the ſame nature with the lee-way; and therefore, whenever a current is perceived, its velocity ought to be determined, and the proper allowances made.

Another ſource of error in reckoning the courſe of a ſhip proceeds from the variation of the compaſs. There are few parts of the world where the needle points exactly north; and in thoſe where the variation is known, it is ſubject to very conſiderable alterations. By theſe means the courſe of the ſhip is miſtaken; for as the ſailors have no other ſtandard to direct them than the compaſs, if the needle, inſtead of pointing due north, ſhould point north-eaſt, a prodigious error would be occaſioned during the courſe of the voyage, and the ſhip would not come near the port to which ſhe was bound. To avoid errors of this kind the only method is, to obſerve the ſun's amplitude and azimuth as frequently as poſſible, by which the variation of the compaſs will be perceived, and the proper allowances can then be made for errors in the courſe which this may have occaſioned.

Errors will ariſe in the reckoning of a ſhip, eſpecially when ſhe ſails in high latitudes, from the ſpheroidal figure of the earth; for as the polar diameter of our globe is found to be conſiderably ſhorter than the equatorial one, it thence follows, that the farther we remove from the equator, the longer are the degrees of latitude. Of conſequence, if a navigator aſſigns any certain number of miles for the length of a degree of latitude near the equator, he muſt vary that meaſure as he approaches towards the poles, otherwiſe he will imagine that he hath not ſailed ſo far as he actually hath done. It would therefore be neceſſary to

to have a table containing the length of a degree of latitude in every different parallel from the equator to either pole; as without this a troublefome calculation muft be made at every time the navigator makes a reckoning of his courfe. Such a table, however, hath not yet appeared; neither indeed does it feem to be an eafy matter to make it, on account of the difficulty of meafuring the length even of one or two degrees of latitude in different parts of the world. Sir Ifaac Newton firft difcovered this fpheroidal figure of the earth; and fhowed, from experiments on pendulums, that the polar diameter was to the equatorial one as 229 to 230. This proportion, however, hath not been admitted by fucceeding calculators. The French mathematicians, who meafured a degree on the meridian in Lapland, made the proportion between the equatorial and polar diameters to be as 1 to 0.9891. Thofe who meafured a degree at Quito in Peru, made the proportion 1 to 0.99624, or 266 to 265. M. Bouquer makes the proportion to be as 179 to 178; and M. Buffon, in one part of his theory of the earth, makes the equatorial diameter exceed the polar one by $\frac{1}{181}$ of the whole. According to M. du Sejour, this proportion is as 321 to 320; and M. de la Place, in his Memoir upon the Figure of Spheroids, has deduced the fame proportion. From thefe variations it appears that the point is not exactly determined, and confequently that any corrections which can be made with regard to the fpheroidal figure of the earth muft be very uncertain.

It is of confequence to navigators in a long voyage to take the neareft way to their port; but this can feldom be done without confiderable difficulty. The fhorteft diftance between any two points on the furface of a fphere is meafured by an arch of a great circle intercepted between them; and therefore it is advifable to direct the fhip along a great circle of the earth's furface. But this is a matter of confiderable difficulty, becaufe there are no fixed marks by which it can be readily known whether the fhip fails in the direction of a great circle or not. For this reafon the failors commonly choofe to direct their courfe by the rhumbs, or the bearing of the place by the compafs. Thefe bearings do not point out the fhorteft diftance between places; becaufe, on a globe, the rhumbs are fpirals, and not arches of great circles. However, when the places lie directly under the equator, or exactly under the fame meridian, the rhumb then coincides with the arch of a great circle, and of confequence fhows the neareft way. The failing on the arch of a great circle is called *great circle failing;* and the cafes of it depend all on the folution of problems in fpherical trigonometry.

PRACTICE OF NAVIGATION.

BOOK I.

Containing the various Methods of Sailing.

Introduction.

The art of navigation depends upon aftronomical and mathematical principles. The places of the fun and fixed ftars are deduced from obfervation and calculation, and arranged in tables, the ufe of which is abfolutely neceffary in reducing obfervations taken at fea, for the purpofe of afcertaining the latitude and longitude of the fhip, and the variation of the compafs. The problems in the various failings are refolved either by trigonometrical calculation, or by tables or rules formed by the affiftance of trigonometry. By mathematics, the neceffary tables are conftructed, and rules inveftigated for performing the more difficult parts of navigation. For thefe feveral branches of fcience, and for logarithmic tables, the reader is referred to the refpective articles in this work. A few tables are given at the end of this article; but as the other tables neceffary for the practice of navigation are to be found in almoft every treatife on that fubject, it therefore feems unneceffary to infert them in this place.

Chap. I. *Preliminary Principles.*

Sect. I. *Of the Latitude and Longitude of a Place.*

The fituation of a place on the furface of the earth is eftimated by its diftance from two imaginary lines interfecting each other at right angles: The one of thefe is called the *equator,* and the other the *firft meridian.* The fituation of the equator is fixed, but that of the firft meridian is arbitrary, and therefore different nations affume different firft meridians. In Britain, we efteem that to be the firft meridian which paffes through the royal obfervatory at Greenwich.

The equator divides the earth into two equal parts, called the *northern* and *fouthern hemifpheres;* and the latitude of a place is its diftance from the equator, reckoned on a meridian in degrees and parts of a degree; and is either north or fouth, according as it is in the northern or fouthern hemifphere.

The firft meridian being continued round the globe, divides it into two equal parts, called the *eaftern* and *weftern hemifpheres;* and the longitude of a place is that portion of the equator contained between the firft meridian and the meridian of the given place, and is either eaft or weft; according as it is in the eaftern or weftern hemifphere, refpectively to the firft meridian.

Prob. I. The latitudes of two places being given, to find the difference of latitude.

Rule. Subtract the lefs latitude from the greater, if the latitudes be of the fame name, but add them if of contrary; and the remainder or fum will be the difference of latitude.

Example I. Required the difference of latitude between the Lizard, in latitude 49° 57′ N. and Cape St Vincent, in latitude 37° 2′ N?

Latitude of the Lizard	49°	57′ N.
Latitude of Cape St Vincent	37	2 N.
Difference of latitude	12	55 = 775 miles.

Example II. What is the difference of latitude between Funchal, in latitude 32° 38′ N. and the Cape of Good Hope, in latitude 34° 29′ S?

Latitude

Latitude and Longitude.

Latitude of Funchal	32° 38′ N.	
Lat. of Cape of Good Hope	34 29 S.	
Difference of latitude	67 7 = 4027 miles.	

Prob. II. Given the latitude of one place, and the difference of latitude between it and another place, to find the latitude of that place.

Rule. If the given latitude and the difference of latitude be of the same name, add them; but if of different names, subtract them, and the sum or remainder will be the latitude required of the same name with the greater.

Example I. A ship from latitude 39° 22′ N. sailed due north 560 miles—Required the latitude come to?

Latitude sailed from	-	39° 22′ N.
Difference of latitude 560′	-	= 9 20 N.
Latitude come to	- -	48 42 N.

Example II. A ship from latitude 7° 19′ N. sailed 854 miles south—Required the latitude come to?

Latitude sailed from	- -	7° 19′ N.
Difference of latitude 854′	-	= 14 14 S.
Latitude come to	- -	6 55 S.

Prob. III. The longitudes of two places being given, to find their difference of longitude.

Rule. If the longitudes of the given places are of the same name, subtract the less from the greater, and the remainder is the difference of longitude: but if the longitudes are of contrary names, their sum is the difference of longitude. If this exceeds 180°, subtract it from 360°, and the remainder is the difference of longitude.

Example I. Required the difference of longitude between Edinburgh and New York, their longitude being 3° 14′ W. and 74° 10′ W. respectively?

Longitude of New York	- -	74° 10′ W.
Longitude of Edinburgh	- -	3 14 W.
Difference of longitude	- -	70 56

Example II. What is the difference of longitude between Markelyne's Isles, in longitude 167° 59′ E. and Olinde, in longitude 35° 5′ W?

Longitude of Markelyne's Isles		167° 59′ E.
Longitude of Olinde	-	35 5 W.
Sum	- - - -	203 4
Subtract from	- -	360 0
Difference of longitude	-	156 56

Prob. IV. Given the longitude of a place, and the difference of longitude between it and another place, to find the longitude of that place.

Rule. If the given longitude and the difference of longitude be of a contrary name, subtract the less from the greater, and the remainder is the longitude required of the same name with the greater quantity; but if they are of different names, add them, and the sum is the longitude sought, of the same name with that given. If this sum exceeds 180°, subtract it from 360°, the remainder is the required longitude of a contrary name to that given.

Example I. A ship from longitude 9° 54′ E. sailed westerly till the difference of longitude was 23° 18′—Required the longitude come to?

Tides.

Longitude sailed from	- -	9° 54′ E.
Difference of longitude	- -	23 18 W.
Longitude come to	- -	13 24 W.

Example II. The longitude sailed from is 25° 9′ W. and difference of longitude 18° 46′ W.—Required the longitude come to?

Longitude left	- -	25° 9′ W.
Difference of longitude	- -	18 46 W.
Longitude in	- -	43 55 W.

Sect. II. *Of the Tides.*

The theory of the tides has been explained under the article Astronomy, and will again be farther illustrated under that of Tides. In this place, therefore, it remains only to explain the method of calculating the time of high water at a given place.

As the tides depend upon the joint actions of the sun and moon, and therefore upon the distance of these objects from the earth and from each other; and as, in the method generally employed to find the time of high water, whether by the mean time of new moon or by the epacts, or tables deduced therefrom, the moon is supposed to be the sole agent, and to have an uniform motion in the periphery of a circle, whose centre is that of the earth; it is hence obvious that method cannot be accurate, and by observation the error is sometimes found to exceed two hours. That method is therefore rejected, and another given, in which the error will seldom exceed a few minutes, unless the tides are greatly influenced by the winds.

Prob. I. To reduce the times of the moon's phases as given in the Nautical Almanac to the meridian of a known place.

Rule. To the time of the proposed phase, as given in the Nautical Almanac, apply the longitude of the place in time, by addition or subtraction, according as it is east or west, and it will give the time of the phase at the given place.

Example I. Required the time of new moon at Salonique in May 1793?

Time of new moon per Naut. Alm.	9ᵈ 15ʰ 31′
Longitude of Salonique in time	0 1 33 E.
Time of new moon required in May	9 17 4

Example II. What is the time of the last quarter of the moon at Resolution Bay in October 1793?

Time of last quarter per Naut. Alm.	26ᵈ 5ʰ 47′
Longitude in time - -	0 9 17 W.
Time at Resolution bay of last quarter, October - -	25 20 30

Prob. II. To find the time of high water at a known place.

Rule. In the Nautical Almanac seek in the given month, or in that immediately preceding or following it, for the time of that phase which happens nearest to the given day: reduce the time of this phase to the meridian of the given place by Prob. I. and take the difference between the reduced time and the noon of the given day.

Find the equation answering to this difference in Table VII. which applied to the time of high water

Tides.

ter on the day of new or full moon at the given place, according as the table directs, will give the approximate time of high water in the afternoon.

Now take the interval between the reduced time of the phaſe and the approximate time of high water; find the correſponding equation, which applied as before to the ſyzigy time of high water, will give the time of the afternoon high water.

If the time of the morning high water is required, increaſe the laſt interval by 12 hours, if the given day falls before the phaſe, or diminiſh it by 12 hours when after that phaſe; and the equation to this time, applied to the ſyzigy time, gives the morning time of high water.

EXAMPLE I. Required the morning and afternoon times of high water at Leith, 11th December 1793?

Neareſt phaſe to 11th Dec. is 1ſt quart.	9^d	20^h	29′
Longitude of Leith in time	— 0	0	13
Time at Leith of 1ſt quarter	9	20	16
Given day - -	11	0	0
Difference - -	1	3	44
Time of H W. at Leith-pier on ſyz.	0	2	20
Equat. from Tab. to 1^d 3^h 44′	+0	6	32
Approximate time of high water	11	8	52
Reduced time of 1ſt quarter -	9	20	16
Interval - - -	1	12	36
Time of high water at Leith on ſyz.	0	2	20
Equat. from the Tab. to 1^d 12^h 36′	0	7	0
Time of high water at Leith		9	20 P.M.
Time of H. W. at Leith at full & change		2	20
Equat. to 1^d 12^h 36′—12^h=1^d 0^h 36′		6	22
High water at Leith, Dec. 11th, at		8	42 A.M.

The time of high water found by the common method is about an hour and a half ſooner.

EXAMPLE II. Required the time of high water at Funchal, 15th November 1793?

The neareſt phaſe to 15th November is that of full moon, - - -	17d	8h	46′
Longitude of Funchal in time, -	0	1	8 W.
Time of full moon at Funchal, -	17d	7	38
Given day, November -	15	0	0
Difference, - -	2	7	38
Time of high water at Funchal at full and change, - -	0	12	4
Equation from the Table to 2d 7h 38′ before full moon, -	—0	1	35
Approx. time of high water, Nov. 15.	0	10	29
Reduced time of full moon, -	17	7	38
Interval, - -	1	11	9
Time of high water at full and change,	0	12	4
Equation to 1d 11h before full moon,	0	0	56
Time of high water, - -	0	11	8 PM.

Equation to 1 d. 11 h.+12 h.=1 d. 23 h. is 1 h. 15′, and 12 h. 4′—1 h. 15′=10 h. 49′=time of high water in the forenoon.

Ship's Run.

EXAMPLE III. Required the time of high water at Duſkey Bay, 24th October 1793?

The neareſt phaſe to the 24th October is the laſt quarter, - -	26d	5h	47′
Longitude of Duſkey Bay in time, -	+0	11	5 E.
Reduced time of firſt quarter of moon,	26	16	52
Given day, - -	24	0	0
Difference, - -	2	16	52
Time of high water at full and change,		10h	57′
Equation to 2d 16h 52′ before laſt quarter, - -		+ 2	52
Approximate time of high water,		1	49
Change of equation to app. time 1h 49′			3
Time of high water in the afternoon,		1	52
Change of equation to 12 hours, -			20
Time of high water in the morning,		1	32

SECT. III. *Of meaſuring a Ship's Run in a given Time.*

The method commonly uſed at ſea to find the diſtance ſailed in a given time, is by means of a log-line and half minute-glaſs. A deſcription of theſe is given under the articles LOG and LOG-LINE, which ſee.

It has been already obſerved, that the interval between each knot on the line ought to be 50 feet, in order to adapt it to a glaſs that runs 30 ſeconds. But although the line and glaſs be at any time perfectly adjuſted to each other, yet as the line ſhrinks after being wet, and as the weather has a conſiderable effect upon the glaſs, it will therefore be neceſſary to examine them from time to time; and the diſtance given by them muſt be corrected accordingly. The diſtance ſailed may therefore be affected by an error in the glaſs, or in the line, or in both. The true diſtance may, however, be found as follows.

PROB. I. The diſtance ſailed by the log, and the ſeconds run by the glaſs, being given, to find the true diſtance, the line being ſuppoſed right.

RULE.—Multiply the diſtance given by the log by 30, and divide the product by the ſeconds run by the glaſs, the quotient will be the true diſtance.

EXAMPLE I. The hourly rate of ſailing by the log is nine knots, and the glaſs is found to run out in 35 ſeconds. Required the true rate of ſailing?

9
30

35)270(7.7=true rate of ſailing.

EXAMPLE II. The diſtance ſailed by the log is 73 miles, and the glaſs runs out in 26 ſeconds. Sought the true diſtance?

73
30

26(2190)84.2 the true diſtance.

PROB. II. Given the diſtance ſailed by the log, and the meaſured interval between two adjacent knots on

Plane Sailing.

the line, to find the true diftance, the glafs running exactly 30 feconds.

Rule. Multiply twice the diftance failed by the meafured length of a knot, point off two figures to the right, and the remainder will be the true diftance.

Example I. The hourly rate of failing by the log is five knots, and the interval between knot and knot meafures 53 feet. Required the true rate of failing?

Meafured interval	=	53
Twice hourly rate	=	10
True rate of failing,	=	5.30

Example II. The diftance failed is 64 miles, by a log-line which meafures 42 feet to a knot. Required the true diftance?

Twice given diftance,	=	128
Meafured interval,		42
		256
		512
True diftance,		53.76

Prob. III. Given the length of a knot, the number of feconds run by the glafs in half a minute, and the diftance failed by the log; to find the true diftance.

Rule. Multiply the diftance failed by the log by fix times the meafured length of a knot, and divide the product by the feconds run by the glafs, the quotient, pointing off one figure to the right, will be the true diftance.

Example. The diftance failed by the log is 159 miles, the meafured length of a knot is 42 feet, and the glafs runs 33 feconds in half a minute. Required the true diftance?

Diftance by the log,	159
Six times length of a knot=42×6=	252
	318
	795
	318

Second run by the glafs = 33)40068(121.4= true diftance.

Chap. II. *Of Plane Sailing.*

Plane failing is the art of navigating a fhip upon principles deduced from the notion of the earth's being an extended plane. On this fuppofition the meridians are efteemed as parallel right lines. The parallels of latitude are at right angles to the meridians; the lengths of the degrees on the meridians, equator, and parallels of latitude, are every where equal; and the degrees of longitude are reckoned on the parallels of latitude as well as on the equator.—In this failing four things are principally concerned, namely, the *courfe*, *diftance*, *difference of latitude*, and *departure*.

The courfe is the angle contained between the meridian and the line defcribed by the fhip, and is ufually expreffed in points of the compafs.

The diftance is the number of miles a fhip has failed on a direct courfe in a given time.

The difference of latitude is the portion of a meridian contained between the parallels of latitude failed from and come to; and is reckoned either north or fouth, according as the courfe is in the northern or fouthern hemifphere.

The departure is the diftance of the fhip from the meridian of the place fhe left, reckoned on a parallel of latitude. In this failing, the departure and difference of longitude are efteemed equal.

Plate CCCXXXVII.

In order to illuftrate the above, let A (fig. 1.) reprefent the pofition of any given place, and AB the meridian paffing through that place; alfo let AC reprefent the line defcribed by a fhip, and C the point arrived at. From C draw CB perpendicular to AB. Now in the triangle ABC, the angle BAC reprefents the courfe, the fide AC the diftance, AB the difference of latitude, and BC the departure.

In conftructing a figure relating to a fhip's courfe, let the upper part of what the figure is to be drawn on reprefent the *north*, then the lower part will be *fouth*, the right-hand fide *eaft*, and the left-hand fide *weft*.

A north and fouth line is to be drawn to reprefent the meridian of the place from which the fhip failed; and the upper or lower part of this line, according as the courfe is foutherly or northerly, is to be marked as the pofition of that place. From this point as a centre, with the chord of 60°, an arch is to be defcribed from the meridian towards the right or left, according as the courfe is eafterly or wefterly; and the courfe, taken from the line of chords if given in degrees, but from the line of rhumbs if expreffed in points of the compafs, is to be laid upon this arch, beginning at the meridian. A line drawn through this point and that failed from, will reprefent the diftance, which if given muft be laid thereon, beginning at the point failed from. A line is to be drawn from the extremity of the diftance perpendicular to the meridian; and hence the difference of latitude and departure will be obtained.

If the difference of latitude is given, it is to be laid upon the meridian, beginning at the point reprefenting the place the fhip left; and a line drawn from the extremity of the difference of latitude perpendicular to the meridian, till it meets the diftance produced, will limit the figure.

If the departure is given, it is to be laid off on a parallel, and a line drawn through its extremity will limit the diftance. When either the diftance and difference of latitude, diftance and departure, or difference of latitude and departure, are given, the meafure of each is to be taken from a fcale of equal parts, is to be laid off on its refpective line, and the extremities connected. Hence the figure will be formed.

Prob. I. Given the courfe and diftance, to find the difference of latitude and departure.

Example. A fhip from St Helena, in latitude 15° 55′ N. failed S. W. by S. 158 miles. Required the latitude come to, and departure?

By conftruction.

Draw the meridian AB (fig. 2.), and with the chord of 60° defcribe the arch *mn*, and make it equal to the rhumb of 3 points, and through *e* draw AC equal to 158 miles; from C draw CB perpendicular to AB; then AB applied to the fcale from which AC was taken, will be found to meafure 131.4 and BC 87.8.

By

By Calculation.

To find the difference of latitude.

As radius - -		10.00000
is to the co-sine of the course	3 points	9.91985
so is the distance -	158	2.19866
to the difference of latitude	131.4	2.11851

To find the departure.

As radius - - -		10.00000
is to the sine of the course	3 points	9.74474
so is the distance -	158	2.19866
to the departure -	87.8	1.94340

By Inspection.

In the traverse table, the difference of latitude answering to the course 3 points, and distance 158 miles, in a distance column is 131.4, and departure 87.8.

By Gunter's Scale.

The extent from 8 points to 5 points, the complement of the course on the line of sine rhumbs (marked SR.) will reach from the distance 158 to 131.4, the difference of latitude on the line of numbers; and the extent from 8 points to 3 points on sine rhumbs, will reach from 158 to 87.8, the departure on numbers.

Latitude St Helena	=	15° 55′	N.
Difference of latitude	-	2 11	S.
Latitude come to	-	13 44	N.

PROB. II. Given the course and difference of latitude, to find the distance and departure.

EXAMPLE. A ship from St George's, in latitude 38° 45′ north, sailed SE¾S; and the latitude by observation was 35° 7′ N. Required the distance, run, and departure?

Latitude St George's	-	38°	45′	N.
Latitude come to	-	35	7	N.
Difference of latitude		3	38 = 218 miles.	

By Construction.

Plate CCCXXXVII. Draw the portion of the meridian AB (fig. 3.) equal to 218 m. from the centre A with the chord of 60° describe the arch *m n*, which make equal to the rhumb of 3½ points: through A*e* draw the line AC, and from B draw BC perpendicular to AB, and let it be produced till it meets AC in C. Then the distance AC being applied to the scale will measure 282 m. and the departure BC 179 miles.

By Calculation.

To find the distance.

As radius - -		10.00000
is to the secant of the course	3½ points	10.11181
so is the difference of latitude	218 m.	2.33846
to the distance -	282	2.45027

To find the departure.

As radius - -		10.00000
is to the tangent of the course	3½ pts.	9.91417
so is the difference of latitude	218	2.33846
to the departure -	178.9	2.25253

By Inspection.

Find the given difference of latitude 218 m. in a latitude column, under the course 3½ points; opposite to which, in a distance column, is 282 miles; and in a departure column is 178.9 m.

By Gunter's Scale.

Extend the compass from 4½ points, the complement of the course to 8 points on sine rhumbs, that extent will reach from the difference of latitude 218 miles to the distance 282 miles in numbers; and the extent from 4 points to the course 3½ points on the line of tangent rhumbs (marked T. R.) will reach from 218 miles to 178.9, the departure on numbers.

PROB. III. Given course and departure, to find the distance and difference of latitude?

EXAMPLE. A ship from Palma, in latitude 28° 37′ N sailed NW by W, and made 192 miles of departure: Required the distance, run, and latitude come to?

By Construction

Make the departure BC (fig. 4.) equal to 192 miles, draw BA perpendicular to BC, and from the centre C, with the chord of 60°, describe the arch *m n*, which make equal to the rhumb of 3 points, the complement of the course; draw a line through C*e*, which produce till it meets BA in A: then the distance AC being measured, will be equal to 231 m. and the difference of latitude AB will be 128.3 miles.

By Calculation.

To find the distance.

As the sine of the course	5 points	9.91985
is to radius - -		10.00000
so is the departure -	192 -	2.28330
to the distance -	230.9	2.36345

To find the difference of latitude.

As the tangent of the course	5 points	10.17511
is to radius - -		10.00000
so is the departure -	192	2.28330
to the difference of latitude	128.3	2.10819

By Inspection.

Find the departure 192 m. in its proper column above the given course 5 points; and opposite thereto is the distance 231 miles, and difference of latitude 138.3, in their respective columns.

By Gunter's Scale.

The extent from 5 points to 8 points on the line of sine rhumbs being laid from the departure 192 on numbers, will reach to the distance 231 on the same line; and the extent from 5 points to 4 points on the line of tangent rhumbs will reach from the departure 192 to the difference of latitude 128.3 on numbers.

Latitude of Palma	-	28°	37′ N
Difference of latitude	- -	2	8 N
Latitude come to	- -	30	45 N

PROB. IV. Given the distance and difference of latitude, to find the course and departure.

EXAMPLE. A ship from a place in latitude 43° 13′ N, sails between the north and east 285 miles; and is then by observation found to be in latitude 46° 31′ N: Required the course and departure?

Latitude sailed from	-	43°	13′ N
Latitude by observation		46	31 N
Difference of latitude	-	3	18 = 198 miles.

By Construction.

Draw the portion of the meridian AB (fig. 5.) equal to 198 miles; from B draw BC perpendicular to

Plane Sailing.

to AB: then take the distance 285 miles from the scale, and with one foot of the compass in A describe an arch intersecting BC in C, and join AC. With the chord of 60° describe the arch *m n*, the portion of which, contained between the distance and difference of latitude, applied to the line of chords, will measure 46°, the course; and the departure BC being measured on the line of equal parts, will be found equal to 205 miles.

By Calculation.

To find the course.

As the distance - -	285	2.45484
is to the difference of latitude	198	2.29660
so is the radius - -		10.00000
to the cosine of the course	46° 0′	9.84176

To find the departure.

As radius - -		10.00000
is to the sine of the course	46° 0′	9.85693
so is the distance - -	285	2.45484
to the departure -	205	2.31177

By Inspection.

Find the given distance in the table in its proper column; and if the difference of latitude answering thereto is the same as that given, namely 198, then the departure will be found in its proper column, and the course at the top or bottom of the page, according as the difference of latitude is found in a column marked *lat.* at top or bottom. If the difference of latitude thus found does not agree with that given, turn over till the nearest thereto is found to answer to the given distance. This is in the page marked 46 degrees at the bottom, which is the course, and the corresponding departure is 205 miles.

By Gunter's Scale.

The extent from the distance 285 to the difference of latitude 198 on numbers, will reach from 90° to 44°, the complement of the course on sines; and the extent from 90° to the course 46° on the line of sines being laid from the distance 285, will reach to the departure 205 on the line of numbers.

Prob. V. Given the distance and departure, to find the course and difference of latitude.

Example. A ship from Fort-Royal in the island of Grenada, in latitude 12° 9′ N, sailed 260 miles between the south and west, and made 190 miles of departure: Required the course and latitude come to?

By Construction.

Plate cccxxxvii. Draw BC (fig 6.) perpendicular to AB, and equal to the given departure 190 miles; then from the centre C, with the distance 260 miles, sweep an arch intersecting AB in it, and join AC. Now describe an arch from the centre A with the chord of 60°, and the portion *m n* of this arch, contained between the distance and difference of latitude, measured on the line of chords, will be 47° the course; and the difference of latitude AB applied to the scale of equal parts, measures miles.

By Calculation.

To find the course.

As the distance -	260 -	2.41497
is to the departure	190 -	2.27875
so is radius - -		10.00000
to the sine of the course	46° 57′	9.86378

To find the difference of latitude.

As radius - -		10.00000
is to the cosine of the course	46° 57′	9.83419
so is the distance -	260	2.41497
to the difference of latitude	177.5	2.24916

By Inspection.

Seek in the traverse table until the nearest to the given departure is found in the same line with the given distance 260. This is found to be in the page marked 47° at the bottom, which is the course; and the corresponding difference of latitude is 177.3.

By Gunter's Scale.

The extent of the compass, from the distance 260 to the departure 190 on the line of numbers, will reach from 90° to 47°, the course on the line of sines: and the extent from 90° to 43°, the complement of the course on sines, will reach from the distance 260 to the difference of latitude $177\frac{1}{2}$ on the line of numbers.

Latitude Fort-Royal - -		12	9 N
Difference of latitude -	177 - =	2	57 S
Latitude in . -		9	12 N

Prob. VI. Given difference of latitude and departure, sought course and distance.

Example. A ship from a port in latitude 7° 56′ S, sailed between the south and east, till her departure is 132 miles; and is then by observation found to be in latitude 12° 3′ S. Required the course and distance?

Latitude sailed from -	7° 56′ S.	
Latitude in by observation	12 3 S.	
Difference of latitude -	4 7	= 247.

By Construction.

Draw the portion of the meridian AB (fig. 7.) equal to the difference of latitude 247 miles; from B draw BC perpendicular to AB, and equal to the given departure 132 miles, and join AC: then with the chord of 60° describe an arch from the centre A; and the portion *mn* of this arch being applied to the line of chords, will measure about ; and the distance AC, measured on the line of equal parts, will be 280 miles.

By Calculation.

To find the course.

As the difference of latitude -	247	2.39270
is to the departure - -	132	2.12057
so is radius - - - -		10.00000
to the tangent of the course -	28° 7′	9.72787

To find the distance.

As radius - -		10.00000
is to the secant of the course	28° 7′	10.05454
so is the difference of latitude	247	2.39270
to the distance -	280	2.44724

By Inspection.

Seek in the table till the given difference of latitude and departure, or the nearest thereto, are found together in their respective columns, which will be under 28°, the required course; and the distance answering thereto is 280 miles.

By Gunter's Scale.

The extent from the given difference of latitude 247 to

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to the departure 132 on the line of numbers, will reach from 45° to 28°, the course on the line of tangents; and the extent from 62°, the complement of the course, to 90° on sines, will reach from the difference of latitude 247 to the distance 280 on numbers.

Chap. III. *Of Traverse Sailing.*

If a ship sails upon two or more courses in a given time, the irregular track she describes is called a *traverse*; and to resolve a traverse is the method of reducing these several courses, and the distances run, into a single course and distance. The method chiefly used for this purpose at sea is by inspection, which shall therefore be principally adhered to; and is as follows.

Make a table of a breadth and depth sufficient to contain the several courses, &c. This table is to be divided into six columns: the several courses are to be put in the first, and the corresponding distances in the second column; the third and fourth columns are to contain the differences of latitude, and the two last the departures.

Now, the several courses and their corresponding distances being properly arranged in the table, find the difference of latitude and departure answering to each in the traverse table; remembering that the difference of latitude is to be put in a north or south column, according as the course is in the northern or southern hemisphere; and that the departure is to be put in an east column if the course is easterly, but in a west column if the course is westerly: Observing also, that the departure is less than the difference of latitude when the course is less than 4 points or 45°; otherwise greater.

Add up the columns of northing, southing, easting, and westing, and set down the sum of each at its bottom; then the difference between the sums of the north and south columns will be the difference of latitude made good, of the same name with the greater; and the difference between the sums of the east and west columns, is the departure made good, of the same name with the greater sum.

Now seek in the traverse table, till a difference of latitude and departure are found to agree as nearly as possible with those above; then the distance will be found on the same line, and the course at the top or bottom of the page according as the difference of latitude is greater or less than the departure.

In order to resolve a traverse by construction, describe a circle with the chord of 60°, in which draw two diameters at right angles to each other, at whose extremities are to be marked the initials of the cardinal points, north being uppermost.

Lay off each course on the circumference, reckoned from its proper meridian; and from the centre to each point draw lines, which are to be marked with the proper number of the course.

On the first radius lay off the first distance from the centre; and through its extremity, and parallel to the second radius, draw the second distance of its proper length; through the extremity of the second distance, and parallel to the third radius, draw the third distance of its proper length; and thus proceed until all the distances are drawn.

A line drawn from the extremity of the last distance to the centre of the circle will represent the distance made good: and a line drawn from the same point perpendicular to the meridian, produced, if necessary, will represent the departure; and the portion of the meridian intercepted between the centre and departure will be the difference of latitude made good.

Examples.

I. A ship from Fyal, in latitude 38° 32′ N, sailed as follows: ESE 163 miles, SW $\frac{1}{4}$ W 110 miles, SE $\frac{3}{4}$ S 180 miles, and N by E 68 miles. Required the latitude come to, the course, and distance made good?

By Inspection.

Course.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
ESE	163	—	62.4	150.6	—
SW$\frac{1}{4}$W	110	—	69.8	—	85.0
SE$\frac{3}{4}$S	180	—	144.5	107.2	—
N*b*E	68	66.7	—	13 3	—
		66.7	276.7	271.1	
			66.7	85.0	
S41$\frac{1}{2}$E	281		210.0	186.1	

Latitude left, -	38° 32′ N.
Difference of latitude,	3 21 S.
Latitude come to -	35 11 N.

By Construction.

With the chord of 60° describe the circle NE,SW (fig. 8), the centre of which represents the place the ship sailed from: draw two diameters NS, EW at right angles to each other; the one representing the meridian, and the other the parallel of latitude of the place sailed from. Take each course from the line of rhumbs, lay it off on the circumference from its proper meridian, and number it in order 1, 2, 3, 4. Upon the first rhumb C1, lay off the first distance from C to A; through it draw the second distance AB parallel to C2, and equal to 110 miles; through B draw BD equal to 180 miles, and parallel to C3; and draw DE parallel to C4, and equal to 68 miles. Now CE being joined, will represent the distance made good; which applied to the scale will measure 281 miles. The arch S*n*, which represents the course, being measured on the line of chords, will be found equal to 41$\frac{1}{2}$°. From E draw EF perpendicular to CS produced; then CF will be the difference of latitude, and FE the departure made good; which applied to the scale will be found to measure 210 and 186 respectively.

Plate CCCXXXVII.

As the method by construction is scarcely ever practised at sea, it therefore seems unnecessary to apply it to the solution of the following examples.

II. A

II. A ship from latitude 1° 38′ S sailed as under. Required her present latitude, course, and distance made good?

Course.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
NW*b*N	43	35.8	—	—	23.9
WNW	78	29.9	—	—	72.1
SE*b*E	56	—	31.1	46.6	—
WSW½W	62	—	18.0	—	59.3
N¾E	85	84.1	—	12.5	—
		149.8	49.1	59.1	155.3
		49.1			59.1
N 44° W	139	100.7=1° 41′			96.2
Latitude left		- 1 38 S.			
Latitude come to		- 0 3 N.			

III. Yesterday at noon we were in latitude 13° 12′ N, and since then have run as follows: SSE 36 miles, S 12 miles, NW ½ W 28 miles, W 30 miles, SW 42 miles, W*b*N 39 miles, and N 20 miles. Required our present latitude, departure, and direct course and distance?

Courses.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
SSE	36	—	33.3	13.8	—
S	12	—	12.0	—	—
NW½W	28	17.8	—	—	21.6
W	30	—	—	—	30.0
SW	42	—	29.7	—	29.7
W*b*N	39	7.6	—	—	38.2
N	20	20.0	—	—	—
		45.4	75.0	13.8	119.5
			45.4		13.8
S 74° W	110		29.6=0°30′		105.7
Yesterday's latitude		-	13 12 N		
Present latitude		-	12 42 N		

IV. The course per compass from Greigsness to the May is SW ¼ S, distance 58 miles; from the May to the Staples S*b*E ¾ E, 44 miles; and from the Staples to Flamborough Head S*b*E, 110 miles. Required the course per compass, and distance from Greigsness to Flamborough Head?

Courses.	Dist.	Diff. of Latitude.		Departure.	
		N	S	E	W
SW ¼ S	58	—	43	—	38.9
S*b*E ¾ E	44	—	41.4	14.8	—
S*b*E	110	—	107.9	21.5	—
			192.3	36.3	38.9
					36.3
					2.6

Hence the course per compass is S 1° E, and distance 110 miles.

Chap. IV. *Of Parallel Sailing.*

The figure of the earth is spherical, and the meridians gradually approach each other, and meet at the poles. The difference of longitude between any two places is the angle at the pole contained between the meridians of those places; or it is the arch of the equator intercepted between the meridians of the given places; and the meridian distance between two places in the same parallel, is the arch thereof contained between their meridians. It hence follows, that the meridian distance, answering to the same difference of longitude, will be variable with the latitude of the parallel upon which it is reckoned; and the same difference of longitude will not answer to a given meridian distance when reckoned upon different parallels.

Parallel sailing is therefore the method of finding the distance between two places lying in the same parallel where longitudes are known; or, to find the difference of longitude answering to a given distance, run in an east or west direction. This sailing is particularly useful in making low or small islands.

In order to illustrate the principles of parallel sailing, let CABP (fig. 9.) represent a section of one part of the earth, the arch ABP being part of a meridian; CA the equatorial; and CP the polar semiaxis. Also let B be the situation of any given place on the earth; and join BC, which will be equal to CA or CP (A). The arch AB, or angle ACB, is the measure of the latitude of the place B; and the arch BP, or angle BCP, is that of its complement. If BD be drawn from B perpendicular to CP, it will represent the cosine of latitude to the radius BC or CA. Plate CCCXXXVII.

Now since circles and similar portions of circles are in the direct ratio of their radii; therefore,

As radius
Is to the cosine of latitude;
So is any given portion of the equator
To a similar portion of the given parallel.

4 S

But

(A) This is not strictly true, as the figure of the earth is that of an oblate spheroid; and therefore the radius of curvature is variable with the latitude. The difference between CA and CP, according to Sir Isaac Newton's hypothesis, is about 17 miles.

Parallel Sailing.

But the difference of longitude is an arch of the equator; and the distance between any two places under the same parallel, is a similar portion of that parallel.

Hence R : cosine latitude :: Diff. longitude : Distance.

And by inversion,

Cosine latitude : R :: Distance : Diff. of longitude.

Also,

Diff. of longitude : Distance :: R : cos. latitude.

Prob. I. Given the latitude of a parallel, and the number of miles contained in a portion of the equator, to find the miles contained in a similar portion of that parallel.

Example I. Required the number of miles contained in a degree of longitude in latitude 55° 58′?

By Construction.

Plate CCCXXXVII. Draw the indefinite right line AB (fig. 10.); make the angle BAC equal to the given latitude 55° 58′, and AC equal to the number of miles contained in a degree of longitude at the equator, namely 60: from C draw CB perpendicular to AB; and AB being measured on the line of equal parts, will be found equal to 33.5, the miles required.

By Calculation.

As radius - - -		10.00000
is to the cosine of latitude,	55° 58′	9.74794
so is miles in a deg. of long. at eq.	60	1.77815
to the miles in deg. in a given par.	33.58	1.52609

By Inspection.

To 56°, the nearest degree to the given latitude, and distance 60 miles, the corresponding difference of latitude is 33.6, which is the miles required.

By Gunter's Scale

The extent from 90° to 34°, the complement of the given latitude on the line of sines, will reach from 60 to 33.6 on the line of numbers.

There are two lines on the other side of the scale, with respect to Gunter's line, adapted to this particular purpose; one of which is intitled *chords*, and contains the several degrees of latitude: The other, marked M. L. signifying *miles of longitude*, is the *line of longitude*, and shows the number of miles in a degree of longitude in each parallel. The use of these lines is therefore obvious.

Example II. Required the distance between Treguier in France, in longitude 3° 14′ W, and Gaspey Bay, in longitude 64° 27′ W, the common latitude being 48° 47′ N?

Longitude Treguier -	3° 14′ W	
Longitude Gaspey Bay	64 27 W	
Difference of longitude	61 13=3673′	
As radius - -		10.00000
is to the cosine of latitude,	48° 47′	9.81882
so is the difference of longitude	3673	3.56502
to the distance - -	2420	3.38384

Prob. II. Given the number of miles contained in a portion of a known parallel, to find the number of miles in a similar portion of the equator.

Example. A ship from Cape Finisterre, in latitude 42° 52′ N, and longitude 9° 17′ W, failed due west 342 miles. Required the longitude come to?

By Construction.

Draw the straight line AB (fig. 11.) equal to the given distance 342 miles, and make the angle BAC equal 42° 52′, the given latitude: from B draw BC perpendicular to AB, meeting AC in C; then AC applied to the scale will measure 466½, the difference of longitude required.

By Calculation.

As radius - -		10.00000
is to the secant of latitude,	42° 52′	10.13493
so is the distance - -	342	2.53403
to the difference of longitude	466.6	2.66896

By Inspection.

The nearest degree to the given latitude is 43°; under which, and opposite to 171, half the given distance in a latitude column, is 234 in a distance column, which doubled gives 468, the difference of longitude.

If the proportional part answering to the difference between the given latitude and that used be applied to the above, the same result with that found by calculation will be obtained.

By Gunter's Scale.

The extent from 47° 8′, the complement of latitude to 90° on the line of sines, being laid the same way from the distance 342, will reach to the difference of longitude 466½ on the line of numbers.

Longitude Cape Finisterre	-	9° 17′ W
Difference of longitude	-	7 47 W
Longitude come to	- -	17 4 W

Prob. III. Given the number of miles contained in any portion of the equator, and the miles in a similar portion of a parallel, to find the latitude of that parallel.

Example. A ship failed due east 358 miles, and was found by observation to have differed her longitude 8° 42′. Required the latitude of the parallel?

By Construction.

Make the line AB (fig. 12.) equal to the given distance; to which let BC be drawn perpendicular, with an extent equal to 522′, the difference of longitude; describe an arch from the centre A cutting BC in C; then the angle BAC being measured by means of the line of chords, will be found equal to 46°⅔, the required latitude.

By Calculation.

As the distance - -	358	2.55388
is to the difference of longitude,	522	2.71767
so is radius - - -		10.00000
to the secant of the latitude	46° 42′	10.16379

By Inspection.

As the difference of longitude and distance exceed the limits of the table, let therefore the half of each be taken; these are 261 and 179 respectively. Now, by entering the table with these quantities, the latitude will be found to be between 46 and 47 degrees. Therefore, to latitude 46°, and distance 261 miles, the corresponding difference of latitude is 181′.3, which exceeds the half of the given distance by 2′.3. Again, to latitude 47°, and distance 261, the difference of latitude is 178′.0, being 1′.0 less than the half of that given: therefore the change of distance answering to a change of 1° of latitude is 3′.3.

Now, as 3′.3 : 2′.3 :: 1° : 42′

Hence the latitude required is 46° 42′.

Parallel Sailing

By Gunter's Scale.

The extent from 522 to 358 on the line of numbers, will reach from 90° to about 43°½, the complement of which 46½ is the latitude required?

Prob. IV. Given the number of miles contained in the portion of a known parallel, to find the length of a similar portion of another known parallel.

Example. From two parts in latitude 33° 58′ N, distance 348 miles, two ships sail directly north till they are in latitude 48° 23′ N. Required their distance?

By Construction.

Plate CCCXXXVII. Draw the lines CB, CE (fig. 13.), making angles with CP equal to the complements of the given latitudes, namely, 56° 2′ and 41° 37′ respectively: make BD equal to the given distance 348 miles, and perpendicular to CP; now from the centre C, with the radius CB, describe an arch intersecting CE in E; then EF drawn from the point E, perpendicular to CP, will represent the distance required; and which being applied to the scale, will measure 278½ miles.

By Calculation.

As the cosine of the latitude left	33° 58′	9.91874
is to the cosine of the latitude come to	48 23	9.82226
so is the given distance	348	2.54158
to the distance required	278.6	2.44510

By Inspection.

Under 34°, and opposite to 174, half the given distance in a latitude column is 210 in a distance column; being half the difference of longitude answering thereto. Now, find the difference of latitude to distance 210 miles over 48° of latitude, which is 140′.5; from which 1′.1 (the proportional part answering to 23 minutes of latitude) being abstracted, gives 139′.8, which doubled is 278′.8, the distance required.

By Gunter's Scale.

The extent from 56° 2′, the complement of the latitude left, to 41° 37′, the complement of that come to on the line of sines, being laid the same way from 348, will reach to 278½, the distance sought on the line of numbers.

Prob. V. Given a certain portion of a known parallel, together with a similar portion of an unknown parallel, to find the latitude of that parallel.

Example. Two ships, in latitude 56 0′ N, distant 180 miles, sail due south; and having come to the same parallel, are now 232 miles distant. The latitude of that parallel is required?

By Construction.

Make DB (fig. 14.) equal to the first distance 180 miles, DM equal to the second 232, and the angle DBC equal to the given latitude 56°; from the centre C, with the radius CB, describe the arch BE; and through M draw ME parallel to CD, intersecting the arch BE in E, join EC and draw EF perpendicular to CD: then the angle FEC will be the latitude required; which being measured, will be found equal to

By Calculation

As the distance on the known parallel	180	2.25527
is to the distance on that required	232	2.36549
so is the cosine of the latitude left	56° 0′	9.74756
to the cosine of the latitude come to	43 53	9.85778

Middle Latitude Sailing.

By Inspection.

To latitude 56°, and half the first distance 90 in a latitude column, the corresponding distance is 161, which is half the difference of longitude. Now 161, and 116 half the second distance, are found to agree between 43 and 44 degrees; therefore, to latitude 43° and distance 161, the corresponding difference of latitude is 117′.7; the excess of which above 116′ is 1′.7: and to latitude 44°, and distance 161, the difference of latitude is 115′.8: hence 117.7—115.8 = 1′.9, the change answering to a change of 1° of latitude.

Therefore 1′.9 : 1′.7 : : 1° : 53′
Hence the latitude is 43° 53′.

By Gunter's Scale.

The extent from 180 to 232 on the line of numbers, being laid in the same direction on the line of sines, from 34°, the complement of the latitude sailed from, will reach to 46° 7′, the complement of the latitude come to.

Chap. V. *Of Middle Latitude Sailing.*

The earth is a sphere, and the meridians meet at the poles; and since a rhumb-line makes equal angles with every meridian, the line a ship describes is therefore that kind of a curve called a *spiral*.

Let AB (fig. 15.) be any given distance sailed upon an oblique rhumb, PBN, PAM the extreme meridians, MN a portion of the equator, and PCK, PEL two meridians intersecting the distance AB in the points CE infinitely near each other. If the arches BS, CD, and AR, be described parallel to the equator, it is hence evident, that AS is the difference of latitude, and the arch MN of the equator the difference of longitude, answering to the given distance AB and course PAB.

Now, since CE represents a very small portion of the distance AB, DE will be the correspondent portion of a meridian: hence the triangle EDC may be considered as rectilineal. If the distance be supposed to be divided into an infinite number of parts, each equal to CE, and upon these, triangles be constructed whose sides are portions of a meridian and parallel, it is evident these triangles will be equal and similar; for, besides the right angle, and hypothenuse which is the same in each, the course or angle CED is also the same. Hence, by the 12th of V. Euc. the sum of all the hypothenuses CE, or the distance AB, is to the sum of all the sides DE, or the difference of latitude AS, as one of the hypothenuses CE is to the corresponding side DE. Now, let the triangle GIH (fig. 16.) be constructed similar to the triangle CDE, having the angle G equal to the course: then as GH : GI : : CE : DC : : AB : AS.

Hence, if GH be made equal to the given distance AB, then GI will be the corresponding difference of latitude.

In like manner, the sum of all the hypothenuses CE, or the distance AB, is to the sum of all the sides CD,

Middle Latitude Sailing.

CD, as CE is to CD, or as GH to HI, becaufe of the fimilar triangles.

The feveral parts of the fame rectilineal triangle will therefore reprefent the courfe, diftance, difference of latitude, and departure.

Although the parts HG, GI, and angle G of the rectilineal triangle GIH, are equal to the correfponding parts AB, AS, and angle A, of the triangle ASB upon the furface of the fphere; yet HI is not equal to BS, for HI is the fum of all the arcs CD; but CD is greater than OQ, and lefs than ZX: therefore HI is greater than BS, and lefs than AR. Hence the difference of longitude MN cannot be inferred from the departure reckoned either upon the parallel failed from or on that come to, but on fome intermediate parallel TV, fuch that the arch TV is exactly equal to the departure: and in this cafe the difference of longitude would be eafily obtained. For TV is to MN as the fine PT to the fine PM; that is, as the cofine of latitude is to the radius.

The latitude of the parallel TV is not, however, eafily determined with accuracy; various methods have therefore been taken in order to obtain it nearly, with as little trouble as poffible: firft, by taking the arithmetical mean of the two latitudes for that of the mean parallel: fecondly, by ufing the arithmetical mean of the cofines of the latitudes: thirdly, by ufing the geometrical mean of the cofines of the latitudes: and laftly, by employing the parallel deduced from the mean of the meridional parts of the two latitudes. The firft of thefe methods is that which is generally ufed.

In order to illuftrate the computations in middle latitude failing, let the triangle ABC (fig. 17.) reprefent a figure in plain failing, wherein AB is the difference of latitude, AC the diftance, BC the departure, and the angle BAC the courfe. Alfo let the triangle DBC be a figure in parallel failing, in which DC is the difference of longitude, BC the meridian diftance, and the angle DCB the middle latitude. In thefe triangles there is therefore one fide BC common to both; and that triangle is to be firft refolved in which two parts are given, and there the unknown parts of the other triangle will be eafily obtained.

Plate CCCXXXVII

Prob. I. Given the latitudes and longitudes of two places, to find the courfe and diftance between them.

Example. Required the courfe and diftance from the ifland of May, in latitude 56° 12′ N, and longitude 2° 37′ W, to the Naze of Norway, in latitude 57° 50′ N, and longitude 7° 27′ E?

Latitude Ifle of May	- 56° 12′ N	-	56° 12′
Latitude Naze of Norway	57 50 N	-	57 50
Difference of latitude	- 1. 38 = 98′		114. 2
Middle latitude	- -	-	57. 1

Longitude Ifle of May	- -	2 37 W
Longitude Naze of Norway	-	7 27 E
Difference of longitude	- -	10 4 = 604′

By Conftruction.

Draw the right line AD (fig. 18.) to reprefent the meridian of the May; with the chord of 60° defcribe the arch *m n*, upon which lay off the chord of 32° 59′, the complement of the middle latitude from *m* to *n*: from D through *n* draw the line DC equal to 604′, the difference of longitude, and from C draw CB perpendicular to AC: make BA equal to 98′, the difference of latitude, and join AC; which applied to the fcale will meafure 343 miles, the diftance fought: and the angle A being meafured by means of the line of chords, will be found equal to 73° 24′, the required courfe.

By Calculation.

To find the courfe (B).

As the difference of latitude	- 98′	-	1.99123
is to the difference of longitude	604	-	2.78104
fo is the cofine of middle latitude	- - 57° 1′		9.73591
to the tangent of the cofine	73 24		10.52572

To find the diftance.

As radius	- - -	10.00000
is to the fecant of the courfe	73° 24′	10.54411
fo is the difference of latitude	98′	1.99123
to the diftance	- 343	2.53534

By Infpection.

To middle latitude 57°, and 151 one-fourth of the difference of longitude in a diftance column, the correfponding difference of latitude is 82.2.

Now 24.5, one-fourth of the difference of latitude, and 82.2, taken in a departure column, are found to agree neareft on table marked $6\frac{1}{2}$ points at the bottom, which is the cofine; and the correfponding diftance $85\frac{3}{4}$ multiplied by 4 gives 343 miles, the diftance.

By Gunter's Scale.

The extent from 98 the difference of latitude, to 604 the difference of longitude on numbers, being laid the fame way from 33°, the complement of the middle latitude on fines, will reach to a certain point beyond the termination of the lines on the fcale. Now the extent between this point and 90° on fines, will reach from 45° to 73° 24′, the courfe on the line of tangents. And the extent from 73° 24′ the courfe, to 33° the complement of the middle latitude on the line of fines, being laid the fame way from 604 the difference of longitude, will reach to 343 the diftance on the line of numbers.

The true courfe, therefore, from the ifland of May o the Naze of Norway is 73 N, 24 E, or ENE$\frac{1}{2}$E nearly; but as the variation at the May is $2\frac{1}{4}$ points weft,

(B) For R. : cofine Mid. lat. : : Diff. of long. : Departure;
And diff. of lat. : Dep. : : R. : Tangent courfe.
Hence diff. of lat. : cofine mid. lat. : : diff. of long. : tang. courfe;
Or diff. of lat. : diff. of long. : : cofine mid. lat. : tang. courfe.

Middle Latitude Sailing.

west, therefore the course *per* compass from the May is E$\frac{3}{4}$S.

PROB. II. Given one latitude, course, and distance sailed, to find the other latitude and difference of longitude.

EXAMPLE. A ship from Brest, in latitude 48° 23′N. and longitude 4° 30′ W. sailed SW$\frac{3}{4}$W 238 miles. Required the latitude and longitude come to?

By *Construction.*

Plate cccxxxvii.

With the course and distance construct the triangle ABC (fig. 17.), and the difference of latitude AB being measured, will be found equal to 142 miles: hence the latitude come to is 46° 1′ N, and the middle latitude 47° 12′. Now make the angle DCB equal to 47° 12′; and DC being measured, will be the difference of longitude: hence the longitude come to is

By *Calculation*,

To find the difference of latitude,

As radius		10.00000
is to the co-sine of the course,	4$\frac{1}{4}$	9.77503
so is the distance,	238	2.37658
to the difference of latitude	141.8	2.15161
Latitude of Brest, 48° 23′ N.		48° 23′ N.
Difference of Lat. 2 22 S.	half	1 11 S.
Lat. come to 46° 1′ N.	Mid. Lat.	47 12

To find the difference of longitude (D).

As the co-sine of Mid. Lat.	47° 12′	9.83215
is to the sine of the course	4$\frac{1}{4}$ points	9.90483
so is the distance	238	2.37658
to the difference of longitude	281.3	2.44926
Longitude of Brest		4° 30′W.
Difference of longitude		4 41W.
Longitude come to		9 11W.

By *Inspection.*

To the course 4$\frac{1}{4}$ points, and distance 238 miles, the difference of latitude is 141.8, and the departure 191.1. Hence the latitude come to is 46° 1′N, and middle latitude 47° 12′ Then to middle latitude 47° 12′, and departure 191.1 in a latitude column, the corresponding distance is 281′, which is the difference of longitude.

By Gunter's Scale.

The extent from 8 points to 3$\frac{3}{4}$ points, the complement of the course on sine rhumbs, being laid the same way from the distance 238, will reach to the difference of latitude 142 on the line of numbers; and the extent from 42° 48′ the complement of the middle latitude, to 53° 26′, the course on the line of sines will reach from the distance 238 to the difference of longitude 281 on numbers.

PROB. III. Given both latitudes and course, required the distance and difference of longitude?

EXAMPLE. A ship from St Antonio, in latitude 17° 0′ N, and longitude 24° 25′ W, sailed NW, $\frac{3}{4}$ N, till by observation her latitude is found to be 28° 34′N. Required the distance sailed, and longitude come to?

Latitude St Antonio	17° 0N.	17° 0′N.
Latitude by observation	28 34 N.	28 34 N.
Difference of lat.	11 34=694m	45 34
	Middle lat.	22 47

By Construction.

Construct the triangle ABC (fig. 19), with the given course and difference of latitude, and make the angle BCD equal to the middle latitude. Now the distance AC and difference of longitude DC being measured, will be found equal to 864 and 558 respectively.

By Calculation.

To find the distance.

As radius,		10.00000
Is to the secant of the course	3$\frac{1}{4}$ points	10.09517
So is the difference of lat.	694	2.84136
To the distance	864	2.93653

To find the difference of longitude.

As the cosine of middle latitude	22° 47′	9.96472
Is to the tangent of the course	3$\frac{1}{4}$ points	9.87020
So is the difference of latitude	694	2.84136
To the difference of longitude	558.3	2.74684
Longitude of St Antonio		24° 25′W.
Difference of longitude,		9 18W.
Longitude come to		33 43W.

By Inspection.

To course 3$\frac{1}{4}$ points, and difference of latitude 231.3 one third of that given, the departure is 171.6. and distance 288, which multiplied by 3 is 864 miles.

Again to the middle latitude 22° 47′, or 23°, and departure 171.6 in a latitude column, the distance is 186, which multiplied by 3 is 558, the difference of longitude.

By Gunter's Scale.

The extent from 4$\frac{3}{4}$ points, the complement of the course, to 8 points on the line of sine rhumbs, will reach from the difference of latitude 694 to the distance 864 on numbers; and the extent from the course 36° 34′ to 67° 13′, the complement of middle latitude on sines, will reach from the distance 864 to the difference of longitude 558 on numbers.

PROB. IV. Given one latitude, course, and departure, to find the other latitude, distance, and difference of longitude.

EXAMPLE. A ship from latitude 26° 30′ N. and longitude 45° 30′ W. sailed NE$\frac{1}{4}$N. till her departure is 216 miles. Required the distance run, and latitude and longitude come to?

By Construction.

With the course and departure construct the triangle ABC (fig. 20.), and the distance and difference of latitude being measured, will be found equal to 340 and 263 respectively. Hence the latitude come to is 30° 53′ and middle latitude 28° 42′. Now make the angle BCD equal to the middle latitude, and the difference of longitude DC applied to the scale will measure 246′.

By

(D) This proportion is obvious, by considering the whole figure as an oblique angled triangle.

Middle Latitude Sailing.

By Calculation.

To find the diſtance.

As the ſine of the courſe	$3\frac{1}{4}$ points		9.80236
Is to radius			10.00000
So is the departure	216		2.33445
To the diſtance	340.5		2.53209

To find the difference of latitude.

As the tangent of the courſe	$3\frac{1}{4}$ points		9.91417
is to radius			10.00000
ſo is the departure	216		2.33445
to the difference of lat.	263.2		2.42028
Latitude ſailed from	26° 30′N.		26° 30′N.
Difference of latitude	4 23 N.	half	2 12N.
Latitude come to	30 53N.	Mid. lat.	28 42

To find the difference of longitude.

As radius		10.00000
is to the ſecant of the mid. lat. 28° 42′		10.05693
ſo is the departure	216	2.33445
to the difference of longitude	246.2	2.39138
Longitude left,		45° 30′W.
Difference of longitude		4 6 E.
Longitude come to		41 24 W.

By Inſpection.

Under the courſe $3\frac{1}{4}$ points, and oppoſite to 108 half the departure, the diſtance is 170, and difference of latitude $131\frac{1}{2}$; which doubled, give 340 and 263 for the diſtance and difference of latitude reſpectively.

Again, to middle latitude 28° 42′, and departure 108, the diſtance is 123; which doubled is 246 the difference of longitude.

By Gunter's Scale.

The extent from the courſe $3\frac{1}{4}$ points, on ſine rhumbs, to the departure 216 on numbers, will reach from 8 points on ſine rhumbs to about 340, the diſtance on numbers; and the ſame extent will reach from $4\frac{3}{4}$ points, the complement of the courſe, to 263, the difference of latitude on numbers; and the extent from 61° 18′ the complement of the middle latitude, to 90° on ſines, will reach from the departure 216 to the difference of longitude 246 on numbers.

Prob. V. Given both latitudes and diſtance; to find the courſe and difference of longitude.

Example. From Cape Sable, in latitude 43° 24′N. and longitude 65° 39′W. a ſhip ſailed 246 miles on a direct courſe between the ſouth and eaſt, and is then by obſervation in latitude 40° 48′N. Required the courſe and longitude in?

Latitude Cape Sable,	43° 24′N.		43° 24′N.
Latitude by obſervation,	40 48N.		40 48 N.
Difference of latitude,	2 36=156′		24 12
		Middle latitude	42 6

By Conſtruction.

Plate CCCXXXV.

Make AB (fig. 21.) equal to 156 miles; draw BC perpendicular to AB, and make AC equal to 246 miles. Draw CD, making with CB an angle of 42° 6′ the middle latitude. Now DC will be found to meaſure 256, and the courſe or angle A will meaſure 50° 39′.

Middle Latitude Sailing.

By Calculation.

To find the courſe.

As the diſtance	246	2.39093
is to the difference of latitude	156	2.19312
ſo is radius,		10.00000
to the coſine of the courſe	50° 39′	9.80219

To find the difference of longitude.

As the coſine of middle latitude	42° 6′	9.87039
is to the ſine of the courſe	50 39	9.88834
ſo is the diſtance	246	2.39093
to the difference of longitude	256.4	2.40888
Longitude Cape Sable,		65° 39′W.
Difference of longitude		4 16 E.
Longitude come to		61 23 W.

By Inſpection.

The diſtance 246, and difference of latitude 156, are found to correſpond above $4\frac{1}{2}$ points, and the departure is 190.1. Now, to the middle latitude 42°, and departure 190.1 in a latitude column, the correſponding diſtance is 256, which is the difference of longitude required.

By Gunter's ſcale.

The extent from 246 miles, the diſtance to 156, the difference of latitude on numbers, will reach from 90° to about $39°\frac{1}{3}$, the complement of the courſe on the line of ſines: and the extent from 48°, the complement of the middle latitude, to $50°\frac{2}{3}$, the courſe on ſines, will reach from the diſtance 246m to the difference of longitude 256m on numbers.

Prob. VI. Given both latitudes and departure; ſought the courſe, diſtance, and difference of longitude.

Example. A ſhip from Cape St Vincent, in latitude 37° 2′N. longitude 9° 2′W. ſails between the ſouth and weſt; the latitude come to is 18° 16′N, and departure 838 miles. Required the courſe and diſtance run, and longitude come to?

Latitude Cape St Vincent,	37° 2′N.	37° 2′
Latitude come to	18 16N.	18 16
Difference of latitude	18 46=1126	55 18
	Middle latitude	27 39

By Conſtruction.

Make AB (fig. 22.) equal to the difference of latitude 1126 miles, and BC equal to the departure 838, and join AC; draw CD ſo as to make an angle with CB equal to the middle latitude 27° 39′. Then the courſe being meaſured on chords is about $36°\frac{2}{3}$, and the diſtance and difference of longitude, meaſured on the line of equal parts, are found to be 1403 and 946 reſpectively.

By Calculation.

To find the courſe.

As the difference of latitude	1126	3.05154
is to the departure	838	2.92324
ſo is radius		10.00000
to the tangent of the courſe	36° 39′	9.87170

To

Middle Latitude Sailing.

To find the distance.

As radius - - -		10.00000
is to the secant of the course	36° 39′	10.09566
so is the difference of latitude	1126	3.05154
to the distance -	1403	3.14720

To find the difference of longitude.

As radius - - -		10.00000
is to the secant of the mid. lat.	27° 39′	10.05266
so is the departure -	838	2.92324
to the difference of longitude	946	2.97590
Longitude Cape St Vincent - -		9° 2′W.
Difference of longitude - -		15 46 W.
Longitude come to - -		24 48 W.

By Inspection.

One tenth of the difference of latitude 112.6, and of the departure 83.8, are found to agree under 3¼ points, and the corresponding distance is 140, which multiplied by 10 gives 1400 miles. And to middle latitude 27°⅔, and 209.5 one fourth of the departure in a latitude column, the distance is 236.5; which multiplied by 4 is 946, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 1126 to the departure 838 on numbers, will reach from 45° to 36°⅔ the course on tangents; and the extent from 53°⅓ the complement of the course to 90° on sines, will reach from 1126 to 1403 the distance on numbers. Lastly, the extent from 62°⅓ the complement of the middle latitude, to 90° on sines, will reach from the departure 838 to the difference of longitude 946 on numbers.

Prob. VII. Given one latitude, distance, and departure, to find the other latitude, course, and difference of longitude.

Example. A ship from Bourdeaux, in latitude 44° 50′ N, and longitude 0° 35′ W, sailed between the north and west 374 miles, and made 210 miles of westing. Required the course and latitude and longitude, come to?

By Construction.

Plate cccxxxvii. With the given distance and departure mark the triangle ABC (fig. 23.) Now the course being measured on the line of chords is about 34°⅙, and the difference of latitude on the line of numbers is 309 miles: hence the latitude come to, is 49° 59′ N, and middle latitude 47° 25′. Then make the angle BCD equal to 47° 25′, and DC measured will be 310 miles, the difference of longitude.

By Calculation.

To find the course.

As the distance -	374 -	2.57287
is to the departure -	210 -	2.32222
so is radius - - -		10.00000
to the sine of the course	34° 10′	9.74935

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course	34° 10′	9.91772
so is the distance -	374	2.57287
to the difference of latitude	309.4	2.49059

Latitude Bourdeaux	44° 50′ N -		44° 50′
Difference of latitude	5 9 N	half -	2 35
Latitude come to	49 59 N	Mid. lat.	47 25

Middle Latitude Sailing.

To find the difference of longitude.

As radius - -		10.00000
is to the secant of middle latitude	47° 25′ -	10.16963
so is the departure -	210 -	2.32222
to the difference of longitude	310.3 -	2.49185
Longitude of Bourdeaux -		0° 35′ W
Difference of longitude - -		5 10 W
Longitude in - -		5 45 W

By Inspection.

The half of the distance 187, and of the departure 105, are found to agree nearest under 34°, and the difference of latitude answering thereto is 155; which doubled is 310 miles.

Again, to middle latitude 47° 25′, and departure 105 in a latitude column, the corresponding distance is 155 miles, which doubled is 310 miles, the difference of longitude.

By Gunter's Scale.

The extent from the distance 374 miles to the departure 210 miles on the line of numbers, will reach from 90° to 34° 10′, the course on the line of sines; and the extent from 90° to 55° 50′, the complement of the course on sines, will reach from the distance 374 to the difference of latitude 309 miles on numbers.

Again, the extent from 42° 35′, the complement of the middle latitude, to 90° on sines, will reach from the departure 210 to the difference of longitude 310 on numbers.

Prob. VIII. Given one latitude, departure, and difference of longitude, to find the other latitude, course, and distance.

Example. A ship from latitude 54° 56′ N, longitude 1° 10′ W, sailed between the north and east, till by observation she is found to be in longitude 5° 26′ E, and has made 220 miles of easting. Required the latitude come to, course, and distance run?

Longitude left - -	1° 10′ W
Longitude come to -	5 26 E
Difference of longitude -	6 36 = 396

By Construction.

Make BC (fig. 24.) equal to the departure 220, and CD equal to the difference of longitude 396:—then the middle latitude BCD being measured, will be found equal to 56° 15′: hence the latitude come to is 57° 34′, and difference of latitude 158°. Now make AB equal to 158, and join AC, which applied to the scale, will measure 271 miles. Also the course BAC being measured on chords will be found equal 54⅓.

By Calculation.

To find the middle latitude.

As the departure -	220 -	2.34242
is to the difference of longitude - -	396 -	2.59769
so is radius - -		10.00000

to the secant of the middle latitude	56° 15′ -	10.25527

Double the middle latitude	112	30
Latitude left -	54	56
Latitude come to -	57	34
Difference of latitude -	2	38 = 158

To find the course.

As the difference of latitude	158	-	2.19866
is to the departure -	220	-	2.34242
so is radius -	-		10.00000
to the tangent of the course	54° 19′		10.14376

To find the distance.

As radius -	-		10.00000
is to the secant of the course	54° 19′		10.23410
so is the difference of latitude	158	-	2.19866
to the distance -	270.9	-	2.43276

By Inspection.

As the difference of longitude and departure exceed the limits of the tables, let therefore their halves be taken; these are 198 and 110 respectively. Now these are found to agree exactly in the page marked 5 points at the bottom. Whence the middle latitude is 56° 15′, and difference of latitude 158 miles.

Again, the difference of latitude 158 and departure 220 will be found to agree nearly above 54° the course, and the distance on the same line is 271 miles.

By Gunter's Scale.

The extent from the difference of longitude 396 to the departure 220 on numbers, will reach from 90° to 33° 45′, the complement of the middle latitude on sines; and hence the difference of latitude is 158 miles. Now the extent from 158 to 220 on numbers, will reach from 45° to 54°$\frac{1}{3}$ on tangents; and the extent from the complement of the course 35°$\frac{2}{3}$ to 90° on sines, will reach from the difference of latitude 158 to the distance 271 on numbers.

Prob. IX. Given the course and distance sailed, and difference of longitude; to find both latitudes.

Example. A ship from a port in north latitude, sailed SE$\frac{1}{4}$S 438 miles, and differed her longitude 7° 28′. Required the latitude sailed from, and that come to?

By Construction.

Plate ccxxxvii. With the course and distance construct the triangle ABC (fig. 25.) and make DC equal to 448 the given difference of longitude. Now the middle latitude BCD will measure 48° 58′, and the difference of latitude AB 324 miles: hence the latitude left is 51° 40′, and that come to 46° 16′.

By Calculation.

To find the difference of latitude.

As radius -	-	-	10.00000
is to the cosine of the course	3$\frac{1}{4}$ pts.	-	9.86979
so is the distance -	438	-	2.64147
to the difference of latitude	324.5	-	2.51126

To find the middle latitude.

As the difference of longitude	448	-	2.65128
is to the distance -	438	-	2.64147
so is the sine of the course	3$\frac{1}{4}$ pts.		9.82708
to the cosine of the middle latitude	48° 58′	-	9.81727

half difference of latitude	2	42
Latitude sailed from -	51	40
Latitude come to -	46	16

By Inspection.

To the course 3$\frac{1}{4}$ points, and half the distance 219 miles, the departure is 147.0, and difference of latitude 162.2; which doubled is 324.4. Again, to half the difference of longitude 224 in a distance column, the difference of latitude is 149.9 above 48°, and 146.9 over 49°.

Now, as 30 : 29 : : 60′ : 58′

Hence the middle latitude is 48° 58′: the latitude sailed from is therefore 51° 40′, and latitude come to 46° 16′.

By Gunter's Scale.

The extent from 8 points to 4$\frac{3}{4}$ points, the complement of the course on sine rhumbs, will reach from the distance 438 miles to the difference of latitude 3245 on numbers. And the extent from the difference of longitude 448, to the distance 438 on numbers, will reach from the course 42° 11′ to the complement of the middle latitude 41° 2′ on sines. Hence the latitude left is 51° 40′, and that come to 46° 16′.

Prob. X. Given the course, difference of latitude, and difference of longitude; to find both latitudes and distance.

Example. From a port in south latitude a ship sailed SW$\frac{1}{2}$W, and has made 690 miles of difference of latitude, and 20° 38′ of difference of longitude.—Required both latitudes and distance?

By Construction.

Construct the triangle ABC (fig. 26.) with the given course and difference of latitude, and make CD equal to 1228 the difference of longitude. Then AC applied to the scale will measure 1088 miles; and the middle latitude BCD will measure 46° 47′. Hence the latitude left is 41° 2′, and the latitude come to 52° 32′.

By Calculation.

To find the distance.

As radius -	-		10.00000
is to the secant of the course	4$\frac{1}{2}$ pts.		10.19764
so is the difference of latitude	690	-	2.83885
to the distance -	1088	-	3.03649

To find the middle latitude.

As the difference of longitude	1228	-	3.08920
is to the distance -	1088	-	3.03649
so is the sine of the course	4$\frac{1}{2}$ pts.		9.88819
to the cosine of the middle latitude	46° 47′		9.83548

Half difference of latitude -	5	45
Latitude sailed from -	41	2
Latitude come to -	52	32

By Inspection.

To the course 4$\frac{1}{2}$ points, and one-fourth of the given difference of latitude 172.5 the departure is

5 210.2

Middle Latitude Sailing.

210.2, and distance 272, which multiplied by 4 is 1088.

Now the middle latitude answering to the difference of longitude 1228, and departure 840.8, or their aliquot parts, will be found as in last problem to be 46° 47′. Hence the latitudes are 41° 2′ and 52° 32′ respectively.

By Gunter's Scale.

The extent from the complement of the course $3\frac{1}{2}$ points to 8 points on sine rhumbs, will reach from the difference of latitude 690 to the distance 1088 miles on numbers; and the extent from the difference of longitude 1228 to the distance 1088 on numbers, will reach from the course 50° 38′ to the complement of the middle latitude 43° 13′ on the line of sines.—Hence both latitudes are found as before.

Prob. XI. Given the distance sailed, difference of latitude, and difference of longitude, to find both latitudes and course.

Example. In north latitude, a ship sailed 458 miles on a direct course between the north and west; and then was found to have differed her latitude 296 miles, and longitude 7° 17′. Required both latitudes and course?

By Construction.

With the distance and difference of latitude construct the triangle ABC (fig. 27.) and make CD equal to the difference of longitude 437; then the course BAC will be found to measure 49° 44′, and the middle latitude BCD 36° 54′: Hence the latitude left is 34° 26′, and that come to 39° 22′.

Plate CCCXXXVII.

By Calculation.

To find the course.

As the difference of latitude	296	-	2.47129
is to the distance	458	-	2.66086
so is radius	-		10.00000
to the secant of the course	49° 44′		10.18957

To find the middle latitude.

As the difference of longitude	437	-	2.64048
is to the distance	458	-	2.66086
so is the sine of the course	49 44	-	9.88255
to the cosine of the middle latitude	36 54	-	9.90293
Half difference of latitude	2 28		
Latitude left	34 26		
Latitude come to	39 22		

By Inspection.

To half the distance 229 the difference of latitude is 150.2 at 49°, and 147.2 at 50°.

Then, as 3.0 : 2.2 : : 60′ : 44′

Therefore the course is 49° 44′

Also the departure is 172.8 at 49°, and 175.4 at 50°.

Hence, as 3.0 : 2.2 : : 2.6 : 1.9

Ar[?] 172.8 + 1.9 = 174.7 = half the departure.

Now to half the difference of longitude 218.5 in a distance column, the difference of latitude is 176.8 at 36°, and 174.5 at 37°.

Then, as 2.3 : 2.1 : : 60′ : 54′.

Hence the middle latitude 36° 54′; and therefore the latitude sailed from is 34° 26′, and that come to 39° 22′.

By Gunter's Scale.

The extent from the distance 458 to the difference of latitude 296 on numbers, will reach from 90° to 40° 16′ the complement of the course on sines; and the extent from the difference of longitude 437 to the distance 458 on numbers, will reach from the course 49° 44′, to the complement of the middle latitude 53° 6′ on the line of sines: Hence the latitudes are 34° 26′ and 39° 22′ respectively.

Prob. XII. Given the distance, middle latitude, and difference of longitude, to find both latitudes and course.

Example. The distance is 384 miles between the south and east, the middle latitude 54° 6′, and difference of longitude 6° 36′. Required both latitude and course?

By Construction.

With the middle latitude 54° 6′, and difference of longitude 396, construct the triangle BCD (fig. 28.) and make AC equal to the given distance 384 miles. Then the course BAC will be found to measure 37° 12′, and the difference of latitude AB 306 miles — Hence the latitude sailed from is 56° 39′, and that come to 51° 33′.

Plate CCCXXXVIII.

By Calculation.

To find the course.

As the distance	384	-	2.58433
is to the difference of longitude	396	-	2.59769
so is the cosine of middle latitude	54° 6′	-	9.76817
to the sine of the course	37 12	-	9.78153

To find the difference of latitude.

As radius	-		10.00000
is to the cosine of the course	37° 12′	-	9.90120
so is the distance	384	-	2.58433
to the difference of latitude	305.9	-	2.48553
Middle latitude	54° 6′		
Half difference of latitude	2 33		
Latitude sailed from	56 39 N		
Latitude come to	51 33 N		

By Inspection.

To the middle latitude 54°, and half the difference of longitude 198 in a distance column, the number in a latitude column is 116.4. Now half the distance 192 and 116.4 in a departure column, are found to agree nearly under the course 37°, and the corresponding difference of latitude 153; which doubled is 306 miles. Hence the latitude left is 56° 39′ N, and latitude come to 51° 33′ N.

By Gunter's Scale.

The extent from the distance 384 to the difference of longitude 396 on the line of numbers, will reach from 35° 54′, the complement of the middle latitude, to 37° 12′, the course on the line of sines: And the extent from 90° to 52° 48′ the complement of the course on sines, will reach from the distance 384 to the difference of latitude 306 on numbers. Hence the latitudes are known.

Prob. XIII. To determine the difference of longitude made good upon compound courses, by middle latitude sailing.

Middle Latitude Sailing.

Rule I. With the feveral courfes and diftances find the difference of latitude and departure made good, and the fhip's prefent latitude, as in traverfe failing.

Now enter the traverfe table with the given middle latitude, and the departure in a latitude column, the correfponding diftance will be the difference of longitude, of the fame name with the departure.

Example. A fhip from Cape Clear, in latitude 51° 18′ N, longitude 9° 46′ W, failed as follows:—SWbS 34 miles, WbN 63 miles, NNW 48 miles. and NE$\frac{1}{2}$E 85 miles. Required the latitude and longitude come to?

Courfes.	Dift.	Diff. of latitude N	Diff. of latitude S	Departure E	Departure W
SWbS	54	—	44.9	—	30.0
WbN	63	12.3	—	—	61.8
NNW	48	44.4	—	—	18.4
NE$\frac{1}{2}$E	85	53.9	—	65.7	—
		110.6	44.9	65.7	110.2
		44.9	—	—	65.7
N 34° W	79	65.7 = 1 6N	—	—	44 5

Latitude of Cape Clear	51 18N
Latitude come to -	52 24N
Sum - -	103 42
Middle latitude -	51 51

Now, to middle latitude 51° 51 or 52°, and departure 44.5 in a latitude column, the difference of longitude is 72 in a diftance column.

Longitude of Cape Clear -	9 46 W
Difference of longitude -	1 12 W
Longitude come to -	10° 58′ W

The above method is that always practifed to find the difference of longitude made good in the courfe of a day's run; and will, no doubt, give the difference of longitude tolerably exact in any probable run a fhip may make in that time, efpecially near the equator. But in a high latitude, when the diftances are confiderable, this method is not to be depended on.—To illuftrate this, let a fhip be fuppofed to fail from latitude 57° N, as follows: E 240 miles, N 240 miles, W 240 miles, and S 240 miles: then, by the above method, the fhip will be come to the fame place fhe left. It will, however, appear evident from the following confideration, that this is by no means the cafe; for let two fhips, from latitude 61° N, and diftant 240 miles, fail directly fouth till they are in latitude 57° N; now their diftance being computed by Problem IV. of Parallel Sailing, will be 269.6 miles; and, therefore, if the fhip failed as above, fhe will be 29.6 miles weft of the place failed from; and the error on longitude will be equal to 240 × fecant 61° — fecant 57° = 29.6 × fecant 57°.

Theorems might be inveftigated for computing the errors to which the above method is liable. Thefe corrections may, however, be avoided, by ufing the following method.

Rule II. Complete the traverfe table as before, to which annex five columns: the firft column is to contain the feveral latitudes the fhip is in at the end of each courfe and diftance; the fecond, the fums of each following pair of latitude; the third, half the fums, or middle latitudes; and the fourth and fifth columns are to contain the differences of longitude.

Now find the difference of longitude anfwering to each middle latitude and its correfponding departure, and put them in the eaft or weft difference of longitude columns, according to the name of the departure. Then the difference of the fums of the eaft and weft columns will be the difference of longitude made good, of the fame name with the greater.

Ex. A fhip from Halliford in Iceland, in lat. 64° 30′ N, long. 27° 15′ W, failed as follows: SSW 46 miles, SW 61 miles, SbW 59 miles, SEbE 86 miles, SbE$\frac{1}{2}$E 76 miles. Required the lat. and long. come to?

Traverse Table.

Courfes.	Dift	Diff. of Lat N	Diff. of Lat S	Departure E	Departure W
SSW	46	—	42.5	—	17.6
SW	61	—	43.1	—	43.1
SbW	59	—	57.9	—	11.5
SbE	86	—	47.8	71.5	—
SE$b\frac{1}{2}$E	76	—	72.7	22.0	—
			264.0	93.5	72.2
				72.2	
By Rule I.				21.3	

Latitude Halliford - -	64° 30′ N
Difference of latitude -	4 24 S
Latitude in - -	60 6 N
Sum - -	124 36
Middle latitude -	62 18

Now, to middle lat. 62 18, and departure 21.3, the difference of long. is 46 E.

Longitude Halliford -	27 15 W
Longitude in - -	16 9

The Error of comm. method, in this Ex. is 12′.

Longitude Table.

Succeffive Latitudes.	Sums.	Middle Latitude.	Diff. of Longitude E	Diff. of Longitude W
64° 30′	—	—	—	—
63 48	128° 18′	64° 9′	—	40.4
63 5	126 53	63 27	—	96.4
62 7	125 12	62 36	—	25.0
61 19	123 26	61 43	150.9	—
60 6	121 25	60 43	45.0	—
			195.9	161.8
			161.8	

Difference of longitude -	34.1
Longitude Halliford -	27.15 W
Longitude in - -	26.41 W

CHAP. VI. *Of Mercator's Sailing.*

It was obferved in Middle Latitude Sailing, that the difference of longitude made upon an oblique rhumb could not be exactly determined by ufing the middle latitude. In Mercator's failing, the difference of longitude is very eafily found, and the feveral problems of failing refolved with the utmoft accuracy, by the affiftance of Mercator's chart or equivalent tables.

In Mercator's chart the meridians are ftraight lines parallel to each other; and the degrees of latitude, which at the equator are equal to thofe of longitude, encreafe with the diftance of the parallel from the equator. The parts of the meridian thus encreafed are called *meridional parts*. A table of thefe parts was firft conftructed by Mr Edward Wright, by the continual addition of the fecants of each minute of latitude.

For by parallel failing,

R : cof. of lat. :: part of equat. : fimilar part of parallel.

And becaufe the equator and meridian on the globe are equal, therefore,

R : cof. lat. : : part of meridian : fimilar part of parallel.

Or fec. lat. : R :: part of merid. : fimilar part of parallel.

Hence, $\frac{\text{fecant latitude}}{\text{part of meridian}} = \frac{\text{R}}{\text{part of parallel.}}$

But in Mercator's chart the parallels of latitude are equal, and radius is a conftant quantity. If therefore the latitude be affumed fucceffively equal to 1′, 2′, 3′, &c. and the correfponding parts of the enlarged meridian be reprefented by *a*, *b*, *c*, &c.; then,

$$\frac{\text{fecant } 1'}{\text{part of mer. } a} = \frac{\text{fecant } 2'}{\text{part of mer. } b} = \frac{\text{fecant } 3'}{\text{part of mer. } c.} \text{ \&c}$$

Hence fecant 1′ : part of mer. *a* : : fecant 2′ : part of mer. *b* : : fecant 3′ : part of mer. *c*, &c.

Therefore by 12th V. Euclid,

Secant 1′ : part of mer. *a* : : fecant 1′ + fecant 2′ + fecant 3′, &c. : parts of mer $a+b+c$, &c.

That is, the meridional parts of any given latitude is equal to the fum of the fecants of the minutes in that latitude (D).

Since CD : LK : : R : fecant LD, fig. 15.

And in the triangle CED,

ED : CD : : R : tangent CED;

Therefore, ED : LK : : R² : fecant LD×tangent CED

$$\text{Hence LK} = \frac{\text{ED} \times \text{fec LD} \times \text{tang. CED}}{\text{R}^2} = \frac{\text{ED} \times \text{fec. LD}}{\text{R}} \times \frac{\text{tang CED}}{\text{R.}}.$$

But $\frac{\text{ED} \times \text{fec. LD}}{\text{R}}$ is the enlarged portion of the meridian anfwering to ED. Now the fum of all the quantities $\frac{\text{ED} \times \text{fecant LD}}{\text{R}}$ correfponding to the fum of all the ED's contained in AS will be the meridional parts anfwering to the difference of latitude AS; and MN is the fum of all the correfponding portions of the equator LK.

$$\text{Whence MN} = \text{mer. diff. of lat.} \times \text{tangent } \frac{\text{CED}}{\text{R.}}$$

That is, the difference of longitude is equal to the meridional difference of latitude multiplied by the tangent of the courfe, and divided by the radius.

This equation anfwers to a right-angled rectilineal triangle, having an angle equal to the courfe; the adjacent fide equal to the meridional difference of latitude, and the oppofite fide the difference of longitude. This triangle is therefore fimilar to a triangle conftructed, with the courfe and difference of latitude, according to the principles of plane failing, and the homologous fides will be proportional. Hence if, in fig. 29. the angle A reprefents the courfe AB the difference of latitude, and if AD be made equal to the meridional difference of latitude; then DE, drawn perpendicular to AD, meeting the diftance produced to E, will be the difference of longitude. Plate CCCXXXVIII.

It is fcarce neceffary to obferve, that the meridional difference of latitude is found by the fame rules as the proper difference of latitude; that is, if the given latitudes be of the fame name, the difference of the correfponding meridional parts will be the meridional difference of latitude; but if the latitudes are of a contrary denomination, the fum of thefe parts will be the meridional difference of latitude.

Prob. I. Given the latitudes and longitudes of two places, to find the courfe and diftance between them.

Example. Required the courfe and diftance between Cape Finifterre, in latitude 42° 52′ N, longitude 9° 17′ W, and Port Praya in the ifland of St Jago, in latitude 14° 54′ N, and longitude 23° 29′ W?

Lat. Cape Finifterre	42° 52′	Mer. parts	2852
Latitude Port Praya	14 54	Mer. parts	904
Difference of lat. =	27 58	Mer. diff. lat.	1948
	1678		

Longitude Cape Finifterre	-	9° 17′ W
Longitude Port Praya	-	23 29 W
Diff. longitude	-	14 12=852.

By Conftruction.

Draw the ftraight line AD (fig. 29.) to reprefent the meridian of Cape Finifterre, upon which lay off AB, AD equal to 1678 and 1948, the proper and meridional differences of latitude; from D draw DE perpendicular to AD, and equal to the difference of longitude 852 join AE, and draw BC parallel to DE; then the diftance AC will meafure 1831 miles, and the courfe BAC 23° 37′.

By Calculation.

To find the courfe.

As the meridian difference of lat.	1948	3.28959
is to the difference of longitude	852	2.93044
fo is radius - - -		10.00000
to the tangent of the courfe	23° 37	9.64085

To find the diftance.

As radius - - -		10.00000
is to the fecant of the courfe,	23° 37′	10 03798
fo is the difference of latitude	1678	3.22479
to the diftance -	1831	3.26277

By

(D) This is not ftrictly true; for inftead of taking the fum of the fecants of every minute in the diftance of the given parallel from the equator, the fum of the fecants of every point of latitude fhould be taken.

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By Inspection.

As the meridian difference of latitude and difference of longitude are too large to be found in the tables, let the tenth of each be taken; these are 194.8 and 85.2 respectively. Now these are found to agree nearest under 24°; and to 167.8, one-tenth of the proper difference of latitude, the distance is about 183 miles, which multiplied by 10 is 1830 miles.

By Gunter's Scale.

The extent 1948, the meridional difference of latitude, to 852, the difference of longitude on the line of numbers, will reach from 45° to 23° 37′, the course on the line of tangents. And the extent from 66° 23′, the complement of the course to 90° on sines, will reach from 1678, the proper difference of latitude, to 1831, the distance on the line of numbers.

Prob. II. Given the course and distance sailed from a place whose situation is known, to find the latitude and longitude of the place come to.

Example. A ship from Cape Hinlopen in Virginia, in latitude 38° 47′ N, longitude 75° 4′ W, sailed 267 miles NE*b*N. Required the ship's present place?

By Construction.

Plate CCCXXXVIII. With the course and distance sailed construct the triangle ABC (fig. 30.); and the difference of latitude AB being measured, is 222 miles: hence the latitude come to is 42° 29′ N, and the meridional difference of latitude 293. Make AD equal to 293; and draw DE perpendicular to AD, and meeting AC produced in E: then the difference of longitude DE being applied to the scale of equal parts will measure 196; the longitude come to is therefore 71° 48′ W.

By Calculation.

To find the difference of latitude.

As radius - -		10.00000
is to the cosine of the course,	3 points	9.91985
so is the distance -	267	2.42651
to the difference of latitude	222	2.34636

Lat. Cape Hinlopen = 38° 47′ N. Mer. parts 2528
Difference of lat. 3 42 N.

Latitude come to 42 29 N. Mer. parts 2821

Meridional difference of lat. 293

To find the difference of longitude.

As radius - -		10.00000
is to the tangent of the course,	3 points	9.82489
so is the mer. diff. of latitude	293	2.46687
to the difference of longitude	195.8	2.29176

Longitude Cape Hinlopen 75° 4′ W
Difference of longitude - 3 16 E

Longitude come to - 71 48 W

By Inspection.

To the course 3 points, and distance 267 miles, the difference of latitude is 222 miles: hence the latitude in, is 42° 29′, and the meridional difference of latitude 293. Again, to course 3 points, and 146.5 half the mer. difference of latitude, the departure is 97.9, which doubled is 195.8, the difference of longitude.

By Gunter's Scale.

The extent from 8 points to the complement of the course 5 points on sine rhumbs, will reach from the distance 267 to the difference of latitude 222 on numbers; and the extent from 4 points to 3 points on tangent rhumbs, will reach from the meridional difference of latitude 293 to the difference of longitude 196 on numbers.

Prob. III. Given the latitudes and bearing of two places, to find their distance and difference of longitude.

Example. A ship from Port Canso in Nova Scotia, in latitude 45° 20′ N, longitude 60° 55′ W, sailed SE $\frac{1}{4}$ S, by observation is found to be in latitude 41° 14′ N. Required the distance sailed, and longitude come to?

Lat. Port Canso - 45° 20′ N Mer. parts - 3058
Lat. in by observation 41 14 N Mer. parts - 2720

Difference of lat. - 4 6 Mer. diff. lat. 338

246

By Construction.

Make AB (fig. 31.) equal to 246, and AD equal to 338; draw AE, making an angle with AD equal to $3\frac{1}{4}$ points, and draw BC, DE perpendicular to AD. Now AC being applied to the scale, will measure 332, and DE 306.

By Calculation,

To find the distance.

As radius - -		10.00000
is to the secant of the course,	$3\frac{1}{4}$ points	10.13021
so is the difference of latitude	246	2.39093
to the distance - -	332	2.52114

To find the difference of longitude.

As radius - -		10.00000
is to the tangent of the course,	$3\frac{1}{4}$ points	9.95729
so is the mer. diff. of latitude	338	2.52892
to the difference of longitude	306.3	2.48621

Longitude Port Canso - 60° 55′ W
Difference of longitude - 5 6 E

Longitude in - - 55 49 W

By Inspection.

Under the course $3\frac{1}{4}$ points, and opposite to half the difference of latitude, 123 in a latitude column is 166 in a distance column, which doubled is 332 the distance; and opposite to 169, half the meridional difference of latitude in a latitude column, is 153 in a departure column, which doubled is 306, the difference of longitude.

By Gunter's Scale.

The extent from the complement of the course $4\frac{3}{4}$ points to 8 points on sine rhumbs, will reach from the difference of latitude 246 m. to the distance 332 on numbers; and the extent from 4 points, to the course $3\frac{1}{4}$ points on tangent rhumbs, will reach from the meridional difference of latitude 338 to the difference of longitude 306 on numbers.

Prob. IV Given the latitude and longitude of the place sailed from, the course, and departure; to find the distance, and the latitude and longitude of the place come to.

Example. A ship sailed from Sallee in latitude 33° 58′ N, longitude 6° 20′ W, the corrected course was NW*b*W $\frac{1}{2}$ W, and departure 420 miles. Required the

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the distance run, and the latitude and longitude come to?

By Construction.

Plate CCCXXXVIII

With the course and departure construct the triangle ABC (fig. 32); now AC and AB being measured, will be found equal to 476 and 224 respectively: hence the latitude come to is 37° 42′ N, and meridional difference of latitude 276. Make AD equal to 276; and draw DE perpendicular thereto, meeting the distance produced in E; then DE applied to the scale will be found to measure 516′. The longitude in therefore is 14° 56′ W.

By Calculation.

To find the distance.

As radius - - -		10.00000
is to the cosecant of the course,	5¼ pts	10.05457
so is the departure - -	420	2.62325
to the distance - -	476.2	2.67782

To find the difference of latitude.

As radius - -		10.00000
is to the co-tangent of the course,	5¼ pts	9.72796
so is the departure -	420	2.62325
to the difference of latitude -	224.5	2.35121

Lat. of Sallee	33° 58′ N	Mer. parts 2169
Diff. of lat.	3 44 N	
Latitude in	37 42 N	Mer. parts 2445
Mer. difference of latitude		276

To find the difference of longitude.

As radius - - -		10.00000
is to the tangent of the course	5¼ pts	10.27204
so is the mer. diff. of latitude	276	2.44091
to the difference of longitude	516.3	2.71295

Longitude of Sallee -	6° 20′ W
Difference of longitude -	8 36 W
Longitude in - -	14 56 W

By Inspection.

Above 5¼ points the course, and opposite to 210 half the departure, are 238 and 112; which doubled, we have 476 and 224, the distance and difference of latitude respectively. And to the same course, and opposite to 138, half the meridional difference of latitude, in a latitude column, is 258 in a departure column; which being doubled is 516, the difference of longitude.

By Gunter's Scale.

The extent from 5¼ points, the course on sine rhumbs, to the departure 420 on numbers, will reach from 8 points on sine rhumbs to the distance 476 on numbers; and from the complement of the course 2¾ points on sine rhumbs to the difference of latitude 224 on numbers.

Again, the extent from difference of latitude 224 to the meridional difference of latitude 276 on numbers, will reach from the departure 420 to the difference of longitude 516 on the same line.

PROB. V. Given the latitudes of two places, and their distance, to find the course and difference of longitude.

EXAMPLE. A ship from St Mary's, in latitude 36° 57′ N, longitude 25° 9′ W, sailed on a direct course between the north and east 1162 miles, and is then by observation in latitude 49° 57′ N. Required the course and longitude come to?

Lat. of St Mary's -	36° 57′ N	Mer. parts - 3470
Lat. come to -	49 57 N	Mer. parts 2389
Difference of lat.	13 0	Mer. diff. lat. 1081
	780	

By Construction.

Make AB (fig. 33.) equal to 780, and AD equal to 1081; draw BC, DE perpendicular to AD; make AC equal to 1162 m. and through AC draw ACE. Then the course or angle A being measured, will be found equal to 47° 50′, and the difference of longitude DE will be 1194.

By Calculation.

To find the course.

As the distance - -	1162	3.06521
is to the difference of latitude,	780	2.89209
so is radius - - -		10.00000
to the cosine of the course -	47° 50′	9.82688

To find the difference of longitude.

As radius - -		10.00000
is to the tangent of the course,	47° 50′	10.04302
so is the mer. diff. of latitude	1081	3.03383
to the difference of longitude	1194	3.07685

Longitude of St Mary's -	25° 9′ W
Difference of longitude -	19 54 E
Longitude in -	5 15 W

By Inspection.

Because the distance and difference of latitude exceed the limits of the table, take the tenth of each; these are 116.2 and 78.0: Now these are found to agree nearest above 4½ points, which is therefore the course; and to this course, and opposite to 108.1, one tenth of the meridional difference of latitude, in a latitude column, is 119.3 in a departure column, which multiplied by 10 is 1193, the difference of longitude.

By Gunter's Scale.

The extent from the distance 1162 m. to the difference of latitude 780 m. on numbers, will reach from 90° to 42° 10′ in the line of sines. And the extent 45°, to the course 47° 50′ on the line of tangents, will reach from the meridional difference of latitude 1081 to the difference of longitude 1194 on numbers.

PROB. VI. Given the latitudes of two places, and the departure; to find the course, distance, and difference of longitude.

EXAMPLE. From Aberdeen, in latitude 57° 9′ N, longitude 2° 9′ W. a ship sailed between the south and east till her departure is 146 miles, and latitude come to 53° 32′ N. Required the course and distance run, and longitude come to?

Latitude Aberdeen	57° 9′ N.	mer. parts 4199
Latitude come to	53 32 N.	mer. parts 3817
Difference of latitude	3 37	mer. diff. of lat. 382
	217.	

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Plate cccxxxviii

By Construction.

With the difference of latitude 217m. and departure 146m. construct the triangle ABC (fig. 34.), make AD equal to 382, draw DE parallel to BC, and produce AC to E: Then the course BAC will measure 33° 56′, the distance AC 261, and the difference of longitude DE 257.

By Calculation.

To find the course.

As the difference of latitude	217	2.33646
is to the departure	146	2.16435
so is radius	-	10.00000
to the tangent of the course	33° 56′	9.82789

To find the distance.

As radius	-	10.00000
is to the secant of the course	33° 56′	10.08109
so is the difference of latitude	217	2.33646
to the distance	261.5	2.41755

To find the difference of longitude.

As the difference of latitude	217	2.33646
is to the mer. diff. of latitude	382	2.58206
so is the departure	146	2.16435
to the difference of longitude	257	2.40995
Longitude of Aberdeen		2° 9 W
Difference of longitude		4 17 E
Longitude come to	-	2 8 E

By Inspection.

The difference of latitude 217, and departure 146, are found to agree nearest under 34°, and the corresponding distance is 262 miles. To the same course, and opposite to 190.7, the nearest to 191 half the meridional difference of latitude, is 128.6 in a departure column, which doubled is 257, the difference of longitude.

By Gunter's Scale.

The extent from the difference of latitude 217, to the departure 146 on numbers, will reach from 45° to about 34°, the course on the line of tangents; and the same extent will reach from the meridional difference of latitude 382 to 257, the difference of longitude on numbers.—Again, the extent from the course 34° to 90 on sines, will reach from the departure 146 to the distance 261 on numbers.

Prob. VII. Given one latitude, distance, and departure; to find the other latitude, course, and difference of longitude.

Example. A ship from Naples, in latitude 40° 51′ N, longitude 14° 14′ E, sailed 252 miles on a direct course between the south and west, and made 173 miles of westing. Required the course made good, and the latitude and longitude come to?

By Construction.

With the distance and departure make the triangle ABC (fig. 35.) as formerly.—Now the course BAC being measured by means of a line of chords will be found equal to 43° 21′, and the difference of latitude applied to the scale of equal parts will measure 183′: hence the latitude come to is 37° 48′ N, and meridional difference of latitude 237.—Make AD equal to 237, and complete the figure, and the difference of longitude will measure 224′: hence the longitude in is 10° 30′ E.

8

By Calculation.

To find the course

As the distance	252	2.40140
is to the departure	173	2.23805
so is radius	-	10.00000
to the sine of the course	43° 21′	9.83665

To find the difference of latitude.

As radius		10.00000
is to the cosine of the course	43° 21′	9.86164
so is the distance	252	2.40140
to the difference of latitude	183.2	2.26304

Latitude of Naples	40° 51′ N. Mer. parts	2690
Difference of latitude	3 3 S	
Latitude come to	37 48 N. Mer. parts	2453
Meridional difference of latitude		237

To find the difference of longitude.

As radius		10.00000
is to the tangent of the course	43° 21′	9.97497
so is the mer. diff. of latitude	237	2.37475
to the difference of longitude	223.7	2.34972
Longitude of Naples		14° 14′ E
Difference of longitude		3 44 W
Longitude in	-	10 30 E.

By Inspection.

Under 43° and opposite to the distance 252 m. the departure is 171.8, and under 44°, and opposite to the same distance, the departure is 175.0.

Then as 3.2 : 1.2 :: 60′ : 22′

Hence the course is 43° 22′

Again, under 43° and opposite to 118.5, half the meridional difference of latitude in a latitude column, is 110.5 in a departure column; also under 44° and opposite to 118.5 is 114.4.

Then as 3.2 : 1.2 :: 3.9 : 1.5

And 110.5+1.5 = 112, which doubled is 224, the difference of longitude.

By Gunter's Scale.

The extent from the distance 252 on numbers to 90° on sines will reach from the departure 173 on numbers to the course 43°$\frac{1}{3}$ on sines; and the same extent that will reach from the complement of the course 46°$\frac{2}{3}$ on sines will reach to the difference of latitude on numbers.—Again, the extent from 45° to 43°$\frac{1}{3}$ on tangents will reach from the meridional difference of latitude 237 to the difference of longitude 224 on numbers.

Prob. VIII. Given one latitude, course and difference of longitude; to find the other latitude and distance.

Example. A ship from Tercera, in latitude 38° 45′ N, longitude 27° 6′ W, sailed on a direct course, which, when corrected, was N 32° E, and is found by observation to be in longitude 18° 24′ W. Required the latitude come to, and distance sailed?

Longitude of Tercera		27° 6′ W
Longitude in		18 24 W
Difference of longitude	-	8 42=522

By

Plate CCCXXXVIII

By Construction.

Make the right angled triangle ADE (fig. 36.) having the angle A equal to the course 32°, and the side DE equal to the difference of longitude 522: then AD will measure 835, which added to the meridional parts of the latitude left, will give these of the latitude come to 48° 46′; hence the difference of latitude is 601: make AB equal thereto, to which let BC be drawn perpendicular; then AC applied to the scale will measure 708 miles.

By Calculation.

To find the meridional difference of latitude.

As radius		10.00000
is to the co-tangent of the course	32° 0′	10.20421
so is the difference of longitude	5 22	2.71767
to the mer. difference of latitude	8352	2.92188
Latitude of Tercera 38° 45′ N	Mer parts	2526
	Mer. diff. of lat.	835
Latitude come to 48 46 N.	Mer. parts	3361

Difference of latitude 10 1 = 601 miles.

To find the distance.

As radius		10.00000
is to the secant of the course	32° 0′	10.07158
so is the difference of latitude	601	2.77887
to the distance	707.7	2.85045

By Inspection.

To course 32°, and opposite to 130.5, one fourth of the given difference of latitude in a departure column, the difference of latitude is 208.8, which multiplied by 4 is 835, the meridional difference of latitude; hence the latitude in is 48° 46′ N, and difference of latitude 601.

Again, to the same course, and opposite to 200, one third of the difference of latitude, the distance is 236, which multiplied by 3 gives 708 miles.

By Gunter's Scale.

The extent from the course 32° to 45° on tangents will reach from the difference of longitude 522 to the meridional difference of latitude 835 on numbers.—And the extent from the complement of the course 58° to 90° on sines, will reach from the difference of latitude 601 to the distance 708 miles on numbers.

Prob IX. To find the difference of longitude made good upon compound courses.

Rule. With the several courses and distances, complete the Traverse Table, and find the difference of latitude, departure, and course made good, and the latitude come to as in Traverse Sailing. Find also the meridional difference of latitude

Now, to the course and meridional difference of latitude in a latitude column, the corresponding departure will be the difference of longitude, which applied to the longitude left will give the ship's present longitude.

Example. A ship from Port St Julian, in latitude 49° 10′ S, longitude 68° 44′ W, sailed as follows, ESE 53 miles, SE*b*S 74 miles, E by N 68 m. SE*b*E½E 47 miles, and E 84 miles. Required the ship's present place?

Courses.	Dist.	Diff. of Lat. N	Diff. of Lat. S	Departur E	Departur W
ESE	53		20.3	49.0	
SE*by*S	74		61.5	41.1	
E*by*N	68	13.3		66.7	
SE*by*E½E	47		22.1	41.5	
E	84			84.0	
		13.3	103.9	282.3	
			13.3		
S 72° E	297		90.6 = 1° 31′		

Latitude left,	49 10 S	m. pt. 3397
Latitude come to	50 41 S	m. pt. 3539
Mer. difference of latitude		142

Now to course 72°, and opposite to 71, half the mer. difference of latitude in a latitude column, is 218.7 in a departure column, which doubled is 437, the difference of longitude.

Longitude of Port St Julian	68° 44′ W
Difference of longitude	7 17 E
Longitude come to	61 27 W

Although the above method is that usually employed at sea to find the difference of longitude, yet as it has been already observed, it is not to be depended on, especially in high latitudes; in which case the following method becomes necessary.

Rule II. Complete the Traverse Table as before, to which annex five columns. Now with the latitude left, and the several differences of latitude, find the successive latitudes, which are to be placed in the first of the annexed columns; in the second the meridional parts corresponding to each latitude is to be put; and in the third, the meridional differences of latitude.

Then to each course, and corresponding meridional difference of latitude, find the difference of longitude, which place in the fourth or fifth columns, according as the course is easterly or westerly; and the difference between the sums of these columns will be the difference of longitude made good upon the whole of the same name with the greater.

Remarks.

1. When the course is north or south, there is no difference of longitude.

2. When the course is east or west, the difference of longitude cannot be found by Mercator's Sailing; in this case the following rule is to be used.

To the nearest degree to the given latitude taken as a course, find the distance answering to the departure in a latitude column: this distance will be the difference of longitude.

Example I. Four days ago we took our departure from Faro-head, in latitude 58° 40′ N. and longitude 4° 50′ W, and since have sailed as follows: NW 32 miles, W 69 miles, WNW 93 miles, W*b*S 77 miles, SW 58 miles, and W½S 49 miles—Required our present latitude and longitude?

Tra-

Traverse Table.					
Courses.	Dist.	Diff. of Lat.		Departure.	
		N	S	E	W
NW	32	22.6			22.6
W	69				69.0
WNW	93	35.6			85.9
W*b*S	77		15.0		75.5
SW	58		41.0		41.0
W¾S	49		7.2		48.5
		58.2	63.2		342.5
			58.2		
W 1° S	343		5.0		

Longitude Table.				
Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude.	
			E	W
58° 40′	4370			
59 3	4415	45		45.0
59 3	4415	0		134.0
59 38	4484	69		166.5
59 23	4454	30		151.0
58 42	4374	80		80.0
58 35	4361	13		88.0
				664.5

Longitude of Faro-head - 4° 50′ W.
Difference of longitude - 11 4 W.

Longitude in - - 15 54 W.

Example II. A ship from latitude 78° 15′ N, longitude 28° 14′ E. failed the following courses and distances. The latitude come to is requred, and the longitude, by both methods: the bearing and distance of Hacluit's head-land, in latitude 79° 55′ N. longitude 11° 55 E. is also required?

Traverse Table.					
Courses.	Dist.	Diff. of Latitude		Departure.	
		N	S	E	W
WNW	154	58.9	—	—	142.3
SW	96	—	67.9	—	67.9
NW¼W	89	56.4	—	—	68.8
N*b*E	110	107.9	—	21.5	—
NW¾N	56	45.0	—	—	33.4
S*b*E¼E	78	—	73.4	26.3	—
		268.2	141.3	47.8	312.4
		141.3			47.8
		126.9			264.6

By Rule 1st.

Latitude left 78° 15′ N. Mer. pts = 7817
Diff. of latitude 2 7 N.

Lat. come to 80 22 N. Mer. pts = 8504

Meridional diff. of latitude - 687
As difference of lat. 126.9 2.10346
is to mer. diff. of latit. 687 - 2.83696
so is the departure 264.6 - 2.42256

to difference of longit. 1432 - 3.15606

23° 52′ W.
Longitude left 28 14 E.

Longitude in 4 22 E.

The error of this method, in the present example, is therefore 1° 23′.

Longitude Table.				
Successive Latitudes.	Merid. Parts.	Merid. Diff. Lat.	Diff. of Longitude.	
			E	W
78° 15′	7817		—	
79 14	8120	303	—	731.7
78 6	7774	346	—	346.0
79 2	8056	282	—	343.6
80 50	8676	620	123.6	—
81 35	8970	294	—	218.0
80 22	8504	466	166.7	—
			290.3	1639.3
				290.3
				1349.0

Longitude left - - 28° 14′ E.
Difference of longitude - 22 29 W.

Longitude in - - 5 45 E.

To find the bearing and distance of Hacluit's head-land.

Lat. H. H. = 79° 55′ N. M. P. 8347 Lon. 11° 55′ E.
Lat. ship. = 80 22 N. M. P. 8504 Lon. 5 45 E.

Diff. lat. 0 27 M.D.L. 157 D.L. 6 10

370

Now to 78.5 half the meridional difference of latitude, and 185.0 half the difference of longitude, the course 67°, and opposite to the difference of latitude 27, the distance is 69 miles.—Hence Hacluit's head-land bears S 67° E. distant 69 miles.

Method of resolving the Problems of Mercator's Sailing.

CHAP. VII. *Containing the Method of resolving the several Problems of Mercator's Sailing, by the Assistance of a Table of Logarithmic Tangents.*

PROB. The constant quantity 12.633114 (G) is to the difference or sum of the logarithmic tangents of half the co-latitudes of two places, according as these latitudes are of the same, or a contrary denomination; as the tangent of the course is to the difference of longitude.

Demonst. Let CABP, Plate CCCXXXVIII. fig 37. be a section of one fourth of the earth in the plane of the meridian; and let AC be the radius of the equator, and B any given place whose latitude is therefore AB. Draw BD perpendicular to AC, and BE parallel to it; and let B*b* be a very small portion of the meridian, as one minute.——Now put CA $= r$, DB $= y$, BE $= x$, and $z =$ meridional parts answering to the arch AB.

Then, $x : r :: bn : \frac{r}{x}\times bn$

but, $x : r :: \frac{r}{x}\times bn : \frac{r^2}{x^2}\times bn =$ correspondent portion of the enlarged meridian. Now these being put into fluxions, we have,

$$\dot z = \frac{r^2}{x^2}\times \dot y = \frac{\dot y}{r^2-y^2}$$

Of which the fluent is,

$$z = \frac{2.302585\times r}{2}\times \log. \frac{r+y}{r-y}$$

$$= 2.302585\times r\times \log. \sqrt{\frac{r+y}{r-y}}$$

Now as the meridional parts are expressed in parts of the equator, this equation becomes,

$$z = \frac{2.302585\times 180°\times 60'}{3.15149}\times \log. \sqrt{\frac{r+y}{r-y}} = \frac{1}{.0001263314}\times \log. \sqrt{\frac{r+y}{r-y}},$$

$$\text{But log. } \sqrt{\frac{r+y}{r-y}} = \log. \sqrt{\frac{r+\text{sine AB})}{r-\text{sine AB})}} = \log. \sqrt{\frac{\tan.\ (45+\frac{1}{2}\text{AB})}{\tan.\ (45-\frac{1}{2}\text{AB})}}$$

$$\text{And the tang. } (45-\tfrac{1}{2}\text{AB}) = \frac{1}{\tan.\ (45+\frac{1}{2}\text{AB})}$$

$$\text{Therefore } z = \frac{1}{.00012633114}\times \log.\ \sqrt{\tan.\ (45+\tfrac{1}{2}\text{AB})^2} =$$

$$= \frac{\text{log. tang. } (45+\frac{1}{2}\text{AB})}{.00012633114.} = \frac{\text{log. tang. half co-latitude.}}{.00012633114, \ \&c.}$$

Hence the meridional parts answering to any given latitude, is found by dividing the difference between the log. of the radius and the log. tangent of half the complement of latitude, by the constant quantity .00012633114, &c.; and the meridional difference of latitude is obtained by dividing the difference or sum of the logarithmic tangents of half the co-latitudes, according as they are of the same or a contrary name, by the above quantity.

And the meridional difference of latitude multiplied by the tangent of the course, is equal to the difference of longitude. Hence the proposition is manifest.

This method shall be illustrated with examples performed by calculation: the other methods of solution are purposely omitted.

PROB. I. Given the latitudes and longitudes of two places, to find the course and distance between them.

EXAMPLE. Required the bearing and distance of Ostend, in lat. 51° 14′ N.; long. 2° 56′ E. from Aberdeen, in latitude 57° 9′ N. and longitude 2° 9′ W.?

Long. Aberdeen,	2° 9 W.	
Long. Ostend,	2 56 E.	
Diff. longitude	5 5=305	

Lat. 57° 9′	comp. 32° 51′	half 16° 25½	tangent	9.46951
Lat. 51 14	comp. 38 46	half 19 23	tangent	9.54633
Diff. Lat. 5 55=355			Difference	7682

To find the course.

As the difference of the log. tang. 7682		3.88547
is to the constant logarithm	-	11.10151
so is the diff. of longitude	305	2.48430
to the tangent of the course	26° 38′	9.70034

To find the distance.

As radius	-	10.00000
is to the secant of the course	26° 38′	10.04871
so is the difference of latitude	355	2.55023
to the distance	397.1	2.59894

PROB. II. Given the latitudes and bearing of two places; to find the distance and differ. of longitude.

EXAMPLE. Two days ago we were in latitude 23° 18′S. longitude 16° 54′W.; and having run upon a direct course, which corrected was S. 53°E. we were found to be in latitude 26° 26′S. Required the distance sailed, and longitude come to?

Lat. left, 23° 18′	comp. 66° 42′	half 33° 21′ tang.	9.81831
Lat. come to, 26 26	comp. 63 34	half 31 47 tang.	9.79213
Diff. of Lat. 3 8=188m.		Difference	2618

To

(G) In this case the tangent is to consist of five figures besides the index; but if the table extends to 6 or 7 figures, the above number will be 126.33, &c. or 1263.3, &c.

Method of resolving the Problems of Mercator's Sailing.

Method of resolving the Problems of Mercator's Sailing.

To find the distance.

As radius - - - 10.00000
is to the secant of the course 53° 10.22054
so is the difference of latitude 188 2.27416

to the distance 312.4 2.49470

To find the difference of longitude.

As the constant logarithm - 11.10151
is to the tangent of the course 53° 10.12289
so is the diff. of log. tangents 2618 3.41797

to the difference of longitude 275 2.43935
Longitude left, - - 16° 54 W.
Difference of longitude, - 4 35 E.

Longitude in - - 12 19 W.

Prob. III. Given the latitudes of two places, and the distance between them; to find the course and difference of longitude.

Example. A ship from latitude 48° 10' N. longitude 15° 12' W. sailed on a direct course between the south and west 284 miles, and is then in latitude 44° 52' N. Required the course and longitude come to?

Lat left, 48° 10' N. comp. 41° 50' half 20° 55' tang. 9.58229
Lat in, 44 52 N. comp. 45 8 half 22 34 tang. 9.61865

Diff. of lat. 3 18=198m Difference 3636

To find the course.

As the distance - 284 2.45332
is to the difference of latitude 198 2.29666
so is radius - - - 10.00000

to the cosine of the course 45° 48' 9.84334

To find the difference of longitude.

As the constant logarithm - 11.10151
is to the tangent of the course 45° 48' 10.01213
so is the diff. of logarithm tangents 3636 3.36062

to the difference of longitude 186.7 2.27124
Longitude left, - - 15° 12 W.
Difference of longitude - - 3 7 W.

Longitude come to - - 18 19 W.

Prob. IV. Given both latitudes and departure, to find the course, distance, and difference of longitude.

Example. A ship from latitude 18° 24' S, longitude 3° 25' E. sailed between the north and west upon a direct course, till by observation she is in latitude 12° 42' N. and has made 970 miles of departure.—Required the course, distance, and longitude come to?

Lat. left, 18° 24' S. comp. 71° 36' half 35° 48' cotan. 0.14193
Lat. come to, 12 42 N. comp. 77 18 half 38 39 cotan. 0.09706

Diff. of lat. 31 6=1866 Sum 0.23899

To find the course.

As the difference of latitude 1866 3.27091
is to the departure - - 970 2.98677
so is radius - - - 10.00000

to the tangent of the course, 27° 28' 9.71586

To find the distance.

As radius - - 10.00000
is to the secant of the course 27° 28' 10.05194
so is the difference of latitude 1866 3.27091

to the distance - 2103 3.32285

To find the difference of longitude.

As the constant logarithm - - 11.10151
is to the tangent of the course 27° 28' 9.71586
so is the sum of the log. tangents 23899 4.37838

to the difference of longitude 983.4 2.99273
Longitude left - - 3° 25' E.
Difference of longitude - 16 23 W.

Longitude come to - 12 58 W.

Prob. V. Given one latitude course and distance; to find the other latitude and difference of longitude.

Example. From Scarborough, in latitude 54° 20' N. longitude 0° 10' W. a ship sailed NE¾E 210 miles. Required the latitude and longitude come to?

To find the difference of latitude.

As radius - - - 10.00000
is to the cosine of the course 4¾ points 9.77503
so is the distance - 210 2.32222

to the difference of latitude 125 2.09725

Lat. left, 54° 20' N. comp. 35° 40' half 17° 50' tang. 9.50746
Diff. of lat. 2 5 N.

Lat. in, 56 25 N. comp. 33 35 half. 16 47½ tang. 9.47964

Difference 2782

To find the difference of longitude.

As the constant logarithm - 11.10151
is to the tangent of the course 4¾ pts. 10.12980
so is the difference of log. tang. 2782 3.44436

to the difference of longitude 296.9 2.47265
Longitude of Scarborough - 0 10 W.
Difference of longitude - 4 57 E.

Longitude come to, - - - 4 47 E.

Prob. VI. Given one latitude, course, and departure, to find the other latitude, distance, and difference of longitude.

Example. A ship from latitude 32° 58' N. longitude 16° 28' W. sailed SE½S, and made 164 miles of departure. Required the distance run, and latitude and longitude come to?

To find the distance.

As the sine of the course 3½ pts. 9.80236
is to radius - - 10.00000
so is the departure - 164 2.21484
to the distance - 258.5 2.41248

To find the difference of latitude.

As the tangent of the course 3½ pts. 9.91417
is to radius - - 10.00000
so is the departure 164 2.21484

to the difference of latitude 199.8 2.30067

Lat. left, - 32° 58' N. comp. 57° 2' half 28° 31' tang. 9.73507
Diff. of lat. 3 20 S

Lat. come to, 29 38 N. comp. 60 22 half 30 11 tang. 9.76464

Difference 2957

To find the difference of longitude.

As the constant logarithm - 11.10151
is to the tangent of the course 3½ pts. 9.91417
so is the difference of log. tangents 2957 3.47085

to the difference of longitude 192.1 2.28351

Method of resolving the Problems of Mercator's Sailing.

Longitude

Method of resolving the Problems of Mercator's Sailing.

Longitude left,	- -	16° 28′W.
Difference of longitude,	- -	3 12 E.
Longitude in,	- -	13 16 W.

Prob. VII. Given one latitude, distance, and departure; to find the other latitude, course, and difference of longitude.

Example. A ship from Cape Voltas, in latitude 28° 55′S. longitude 15° 53′E. sailed 286 miles between the south and west, and made 238 miles of departure. Required the course, the latitude and longitude come to?

To find the course.

As the distance -	286	2.45637
is to the departure -	238	2.37658
so is radius - -		10.00000
to the sine of the course	56° 19′	9.92021

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course	56° 19′	9.74398
so is the distance -	286	2.45637
to the difference of latitude	158.6	2.20035

Lat. Cape Voltas, 28° 55′ S.	comp. 61° 5′	half 30° 32½′	tang. 9.77087
Diff. of Lat. 2 39 S.			
Latitude in, 31 34 S.	comp. 58 26	half 29 13	tang. 9.74762
			Difference 2325

To find the difference of longitude.

As the constant logarithm	-	11.10151
is to the tangent of the course	56° 19′	10.17620
so is the diff. of log. tangents	2325	3.36642
to the difference of longitude	276.1	2.44111
Longitude Cape Voltas,	-	15° 53′E.
Difference of longitude,	-	4 36 W.
Longitude come to,	-	11 17 E.

Prob. VIII. Given one latitude, course, and difference of longitude, to find the other latitude and distance.

Example. A ship from latitude 16° 54′N. longitude 62° 16′.W. sailed upon a NW. by N. course, until her longitude by observation is 68° 10′W. Required the distance run, and latitude come to?

Longitude left,	-	62° 16′W.
Longitude come to,	-	68 10 W.
Difference of longitude,	-	5 54=354

To find the latitude come to.

As the tangent of the course	3 pts.	9.82489
is to the constant logarithm,	-	11.10151
so is the difference of longitude	354	2.54900
to the difference of log. tangents,	6693	3.82562

Lat. left, 16° 54′	comp. 73° 6′	half 36° 33′	tang. 9.87000
			Diff. log. tang. 6693
Lat. in, 25 8	64 52	32 26	tang. 9.80307
Diff. of lat. 8 14=494m.			

To find the distance.

As radius - -	-	10.00000
is to the secant of the course	3 points.	10.08015
so is the difference of latitude	494	2.69373
to the distance - -	594.1	2.77388

Prob. IX. Given one latitude, distance, and difference of longitude, to find the course, and other latitude.

Rule. To the arithmetical complement of the logarithm of the distance, add the logarithm of the difference of longitude in minutes, and the log. cosine of the given latitude, the sum rejecting radius will be the log. sine of the approximate course.

To the given latitude taken as a course in the traverse table, and half the difference of longitude in a distance column, the corresponding departure will be the first correction of the course, which is subtractive if the given latitude is the least of the two; otherwise, additive.

In Table A, under the complement of the course, and opposite to the first correction in the side column, is the second correction. In the same table find the number answering to the course at the top, and difference of longitude in the side column; and such part of this number being taken as is found in table B opposite to the given latitude, will be the third correction. Now these two corrections, subtracted from the course corrected by the first correction, will give the true course.

Now the course and distance being known, the difference of latitude is found as formerly.

Table A. Arc.	10°	20°	0°	40°	50°	60°	70°	80°	90°
1°	3′	1′	1′	1′	0′	0′	0′	0′	0′
2	12	6	4	2	2	1	1	0	0
3	27	13	8	6	4	3	2	1	0
4	47	23	14	10	7	5	3	1	0
5	74	36	23	16	11	8	5	2	0
6	107	52	33	22	16	11	7	3	0
7	145	70	44	30	21	15	9	4	0
8	190	92	58	40	28	19	12	6	0

Table B. Lat.	
0°	$\frac{1}{3}$
10	$\frac{1}{3}$
20	$\frac{1}{6}+\frac{1}{7}$
30	$\frac{1}{6}+\frac{1}{8}$
40	$\frac{1}{6}+\frac{1}{10}$
50	$\frac{1}{4}$
60	$\frac{1}{5}$
70	$\frac{1}{6}+\frac{1}{50}$
80, &c.	$\frac{1}{6}$

Example. From latitude 50° N, a ship sailed 290 miles between the south and west, and differed her longitude 5°. Required the course, and latitude come to?

Distance - -	290.	ar. co. log.	7.53760
Dif. of longitude	300	log.	2.47712
Latitude -	50°	cosine	9.80807
Approximate course	41 41	sine	9.82279

To lat. 50°, and half diff. long. 150, the 1st Corr. in a dep. column is 115 +1 55

In

Method of resolving the Problems of Mercator's Sailing.

In table A to co. course 48° and 1ft corr. 1° 55′, the second correction is		—0 2
To course 41° and diff. long 5°, the number is 6′, of which $\frac{1}{5}$ (Tab. B) being taken gives - - -		—0 1
True course		S. 43 33 W

To find the difference of latitude.

As radius - - -		10.00000
is to the cosine of the course	43° 33′	9.86020
so is the distance -	290	2.46240
to the difference of latitude	210.2	2.32260
Latitude left - - -		50° 0′ N
Difference of latitude - - -		3 30 S
Latitude come to - -		46 30 N

It was intended in this place to have given rules, to make allowance for the spheroidal figure of the earth: but as the ratio of the polar to the equatorial semiaxis is not as yet determined with sufficient accuracy, neither is it known if both hemispheres be similar figures; therefore these rules would be grounded on assumption only, and which might probably err more from the truth than those adapted to the spherical hypothesis. This therefore is supposed to be a sufficient apology for not inserting them.

Chap. VIII. *Of Oblique Sailing.*

Oblique sailing is the application of oblique angled plane triangles to the solution of problems at sea. This sailing will be found particularly useful in going along shore, and in surveying coasts and harbours, &c.

Example I. At 11h A.M. the Girdleness bore W NW, and at 2h P.M it bore NW*b*N; the course during the interval S*b*W 5 knots an hour. Required the distance of the Ship from the Ness at each station?

By Construction.

Plate CCCXXXVIII

Describe the circle NE.SW (fig. 38.) and draw the diameters NS. EW at right angles to each other; from the centre C, which represents the first station, draw the WNW line CF; and from the same point draw CH, S*b*W, and equal to 15 miles the distance sailed.—From H draw HF in a NW*b*N direction, and the point F will represent the Girdleness. Now the distances CF, HF will measure 19.1 and 26.5 miles respectively.

By Calculation.

In the triangle FCH are given the distance CH 15 miles; the angle FCH equal to 9 points, the interval between the S*b*W and WNW points; and the angle CHF equal to 4 points, being the supplement of the angle contained between the S*b*W and NW*b*N points; hence CFH is 3 points; to find the distances CF, FH.

To find the distance CF.

As the sine of CFH	3 points	9.74474
is to the sine of CHF -	4 points -	9.84948
so is the distance CH	15 miles -	1.17609
to the distance CF -	19.07 -	1.28083

To find the distance FH.

As the sine of CFH -	3 points -	9.74474
is to the sine of FCH -	9 points -	9.99157
so is the distance CH	15 miles -	1.17609
to the distance FH -	26.48 -	1.42292

Oblique Sailing.

Example II. The distance between the SE point of the island of Jersey and the island of Brehaut is 13 leagues: and the correct bearing and distance of Cape Frehel from the island of Brehaut is SE*b*E 26 miles. It is also known that the SE point of Jersey bears NNE from Cape Frehel: from whence the distance of these two is required, together with the bearing of the said point from the island of Brehaut?

By Construction.

Describe a circle, (fig. 39.) and draw two diameters at right angles, the extremities of which will represent the cardinal points, north being uppermost.—Let the centre B represent Brehaut, from which draw the SE*b*E line BF equal to 26 miles, and the point F will represent Cape Frehel, from which draw the NNE line FI; make BI equal to 39 miles: Then FI applied to the scale will measure 34½ miles, and the inclination of BI to the meridian will be found equal to 63°$\frac{1}{3}$.

By Calculation.

In the triangle BIF are given BI and BF equal to 39 miles, and 26 miles respectively; and the angle BFI equal to 7 points: to find the side FI, and angle FBI.

To find the angle BIF.

As the distance BI -	39	-	1.59106
is to the distance BF -	26	-	1.41497
so is the sine of BFI -	78° 45′		9.99157
to the sine of BIF -	40 50	-	9.81548
Sum - - -	119 35		
Angle FBI -	60 25		
—— EBF -	33 45		
Difference, or EBI -	26 40		

Bearing of Jersey from Brehaut N63 20 E.

To find the distance FI.

As the sine of BFI	78° 45′	-	9.99157
is to the sine of FBI	60 25	-	9.93934
so is the distance BI -	39 miles		1.59106
to the distance FI -	34.58	-	1.53883

Example III. At noon Dungeness bore per compass N*b*W distance 5 leagues; and having run NW*b*W 7 knots an hour, at 5 P.M. we were up with Beachy-head. Required the bearing and distance of Beachy-head from Dungeness?

By Construction.

Describe a circle (fig. 40) to represent the horizon; from the centre C draw the N*b*W line CD equal to 15 miles; and the NW*b*W line CB equal to 35 miles; join DB, which applied to the scale will measure about 26½ miles; and the inclination of DB to the meridian will be found equal to N 79°¼ W.

By Calculation.

In the triangle DBC are given the distances CD, CB equal to 15 and 35 miles respectively; and the angle BCD equal to 4 points; to find the angles B and D, and the distance BD.

To

Oblique Sailing.

To find the angles.

Distance CB = 35	sum of the ang.	16 points	
CD = 15	angle C	4	
Sum 50	angles B and D	12	
Difference 20	half sum	6 pts. = 67° 30′	
As the sum of the distances		50	1.69897
is to their difference		20	1.30103
so is the tangent of half sum angles		67 30	10.38378
to the tangent of half their difference		44 0	9.98484
Angle CDB		111 30	
Supplement		68 30	
Angle NCD		11 15	

Magnetic bearing - N 79 45 W. Or by allowing $2\frac{1}{4}$ points of westerly variation, the true bearing of Beachy-head from Dungeness will be W $\frac{3}{4}$ S nearly.

To find the distance.

As the sine of CDB	-	111° 30′	9.96868
is to the sine of BCD	-	45.0	9.84948
so is the distance BC	-	35	1.54407
to the distance BD	-	26.6	1.42487

Example IV. Running up Channel E*b*S *per* compass at the rate of 5 knots an hour. At 11h A. M. the Eddistone light-house bore N*b*E$\frac{1}{4}$E and the Start point NE*b*E$\frac{1}{4}$E; and at 4 P. M. the Eddistone bore NW*b*N, and the Start N $\frac{3}{4}$ E. Required the distance and bearing of the Start from the Eddistone, the variation being $2\frac{1}{4}$ points W?

By Construction.

Plate CCCXXXVIII. Let the point C (fig. 41) represent the first station, from which draw the N*b*E$\frac{1}{4}$E line CA, the NE*b*E$\frac{1}{4}$E line CB, and the E*b*S line CD, which make equal to 25 miles, the distance run in the elapsed time; then from D draw the NE*b*N line DA intersecting CA in A, which represents the Eddistone; and from the same point draw the N$\frac{3}{4}$E line DB cutting CB in B, which therefore represents the Start. Now the distance AB applied to the scale will measure 22.9, and the bearing *per* compass BAF will measure $73°\frac{1}{3}$.

By Calculation.

In the triangle CAD are given CD equal to 25 miles, the angle CAD equal to $4\frac{1}{4}$ points, the distance between N*b*E$\frac{1}{4}$E and NW*b*N; and the angle ADC equal to 4 points, the distance between the NW*b*N and W*b*N points; to find the distance CA.

As the sine of CAD	$4\frac{1}{4}$ points	-	9.86979
is to the sine of CDA	4 points	-	9.84948
so is the distance CD	25 miles	-	1.39794
to the distance CA	23.86	-	1.37763

In the triangle BCD, are given the distance CD 25 miles, the angle CBD $4\frac{1}{2}$ points the interval between NE*b*E$\frac{1}{4}$E and N$\frac{3}{4}$E; and CDB $7\frac{3}{4}$ points, the distance between W*b*N and N$\frac{3}{4}$E; to find the distance CD.

As the sine of CBD	$4\frac{1}{2}$ points	-	9.88819
is to the sine of CDB	$7\frac{3}{4}$ points	-	9.99947
so is the distance CD	25 miles	-	1.39794
to the distance CB	32.3	-	1.50922

In the triangle CAB, the distances CA, CB, are given, together with the included angle ACB, equal to 4 points, the distance between N*b*E$\frac{1}{4}$E and NE*b*E$\frac{1}{4}$E; to find the angle CAB and distance AB.

Distance CB 32.3	Angle ACB	=	45° 0′
Distance CA 23.86	Sum of CAB and ABC		135 0
Sum - 56.16	Half	-	67 30
Difference 8.44			
As the sum of the distances	56.16	-	1.74943
is to their difference	8.44	-	0.92634
so is the tangent of half sum angles	67 30	-	10.38278
to the tangent of half diff. angles	19 56	-	9.55969
Angle CAB	87 26		
Angle CAF	14 4		

Bearing *per* compass - S 73 22 E or ESE$\frac{1}{2}$E; and the variation $2\frac{1}{4}$ points being allowed to the left of ESE$\frac{1}{2}$E, gives E$\frac{3}{4}$N, the true bearing of the Start from the Eddistone.

To find the distance.

As the sine of CAB	87° 26′	-	9.99956
is to the sine of ACB	45 0	-	9.84948
so is the distance CB	32.3	-	1.50922
to the distance AB	22.86		1.35914

Example V. A ship from a port in latitude 57° 9′ N, longitude 2° 9′ W, sailed 82 miles on a direct course, and spoke a ship that had run 100 miles from a port in latitude 56° 21′ N. longitude 2° 50′ W.—Required the course of each ship, and the latitude and longitude come to?

Lat. -	57° 9′ N	Mer. parts	4199	Lon.	2° 9′ W
——	56 21 N	——	4112	—	2 50 W
Diff. of lat.	48	Mer. diff. lat.	87	Diff. lon.	41

By Construction.

With the meridional difference of latitude, the difference of longitude, and difference of latitude, construct the triangles ADE, ABC (fig. 42.) as in Mercator's Sailing; then A will represent the northernmost, and C the southernmost port. The distance AC applied to the scale will measure 53 miles, and the bearing BCA will be $25°\frac{1}{4}$. From the points A and C, with distances equal to 82 and 100 miles respectively, describe arches intersecting each other in M, which will therefore be the place of meeting.—Now the angle ABM, the ship's course from the southernmost port, will measure N $80°\frac{1}{2}$ E; and the other ship's course, or angle BAM, will be $67°\frac{4}{5}$, or ESE. From M draw the parallel MNP, and AN will be the difference of latitude made by the one ship, and CP that by the other ship: hence either of these being measured and applied to its correspondent latitude, will give 56° 38′, the latitude in. Make AF equal to 57, the meridional difference of latitude between the northernmost port and latitude in: from F draw FG perpendicular to AF, and produce AM to G, then FG will be the difference of longitude, which applied to the scale will measure 139: hence the longitude in, is 0° 10′ E.

By

Oblique Sailing.

By Calculation.

In the triangles ADE, ABC, are given AD equal to 87, DE equal to 41, and AB equal to 48; to find the angle BAC and diftance AC.

To find the bearing of the ports.

As the meridional diff. of lat.	87	1.93952
is to the diff. of long.	41	1.61278
fo is radius		10.00000
to the tangent of the bearing	25° 14′	9.67326

To find the diftance of the ports.

As radius		10.00000
is to the fecant of the bearing	25° 14′	10.04355
fo is the diff. of latitude	48	1.68124
to the diftance	53.06	1.72479

In the triangle AMC, the three fides are given to find the angles.

To find the angle ACM.

AM	82		
MC	100	ar. co. log.	8.00000
AC	53.06	ar. co. log.	8.27523
Sum	235.06		
Half	117.53	log.	2.07015
Difference	35.53	log.	1.55059
			19.89597
	27 29	cofine	9.94798
Angle ACM	54 58		
Angle BAC	25 14		
Southernmoft fhip's courfe	N 80 12 E		

To find the angle MAC.

As AM	82	1.91381
is to MC	100	2.00000
fo is the fine of ACM	54 58	9.91319
to the fine of MAC	93 3	9.99938
Angle BAC	25 14	
Northernmoft fhip's courfe	S 67 49 E, or ESE.	

In the right-angled triangle AMN, given AM, and the angle MAN, to find the differences of latitude AN.

As radius			10.00000
is to the cofine of the courfe	67° 49′		9.57700
fo is the diftance	82		1.91381
to the diff. of lat.	30.96		1.49081
Latitude of northernmoft port	57 9	Mer. parts	4199
Latitude in	56 38	Mer. parts	4142
Meridional difference of latitude			57

To find the difference of longitude FG.

As radius		10.00000
is to the tangent of the courfe	67° 49′	10.38960
fo is the mer. diff. of lat.	57	1.75587
to the diff. of long.	139.8	2.14547
Longitude left	2° 9′ W	
Difference of longitude	2 20 E	
Longitude in	0 11 E	

Windward Sailing.

CHAP. IX. *Of Windward Sailing.*

WINDWARD failing is, when a fhip by reafon of a contrary wind is obliged to fail on different tacks in order to gain her intended port; and the object of this failing is to find the proper courfe and diftance to be run on each tack.

EXAMPLE I. A fhip is bound to a port 48 miles directly to the windward, the wind being SSW, which it is intended to reach on two boards; and the fhip can lie within 6 points of the wind. Required the courfe and diftance on each tack?

By Conftruction.

Plate CCCXXXVIII

Draw the SSW line CB (fig. 43.) equal to 48 miles. Make the angles ACB, ABC, each equal to 6 points. Hence the firft courfe will be W, and the fecond SE: alfo the diftance CA, or AB, applied to the fcale will meafure $62\frac{3}{4}$ miles, the diftance to be failed on each board.

By Calculation.

From A draw AD perpendicular to BC; then in the triangle ADC are given CD, equal to 24 miles; and the angle ACD, equal to 6 points, to find the diftance AC.

As radius		10.00000
is to the fecant of C	6 points	10.41716
fo is CD	24 miles	1.38021
to CA	62.7	1.79737

EXAMPLE II. The wind at NW, a fhip bound to a port 64 miles to the windward, propofes to reach it on three boards; two on the ftarboard, and one on the larboard tack, and each within 5 points of the wind. Required the courfe and diftance on each tack?

By Conftruction.

Draw the NW line CA (fig. 44.) equal to 64 miles; from C draw CB W*b*S, and from A draw AD parallel thereto, and in an oppofite direction; bifect AC in E, and draw BED parallel to the N*b*E rhumb, meeting CB, AD in the points B and D: then CB=AD applied to the fcale will meafure $36\frac{1}{4}$ miles, and BD=2CB=$72\frac{1}{2}$ miles

By Calculation.

From B draw BF perpendicular to AC; then in the triangle BFC are given the angle BCF equal to 5 points, and CF equal to one fourth of CA=16 m. to find CB.

As radius		10.00000
is to the fecant of BCF,	5 points	10.25526
fo is CF	16 m.	1.20412
to CB	36.25	1.55938

EXAMPLE III. A fhip which can lie within $5\frac{1}{2}$ points of the wind, is bound to a port 36 miles to the windward, the wind being NE*b*N, which it is intended to reach

Windward Sailing.

reach on four boards, the first being on the larboard tack. Required the course and distance on each?

By Construction.

Plate ccxxxviii.

Draw the NE*b*N line CA (fig. 45.) equal to 36 miles, and bisect it in B; from C and B draw lines parallel to the E*b*S rhumb; and from A and B draw lines parallel to the SSE½E point, meeting the former in the points D and E. Now the distances AD, BD, BE, and CE, are equal; and any one of them applied to the scale will measure 19.1 miles.

By Calculation.

From E draw EF perpendicular to AC; and in the triangle CFE are given CF=9 m. and the angle FCE =5½ points, to find CE.

As radius		10.00000
is to the secant of FCE	5½ points	10.32661
so is CF	9 miles	0.95424
to the distance CE	19.1 miles	1.28085

Example IV. A ship bound to a port bearing N*b*W distant 40 miles, with the wind at N*b*E½E, intends to reach it on two boards. Required the course and distance on each tack, the ship lying within 5½ points of the wind?

By Construction.

Draw the N*b*W line CA (fig. 46.) equal to 40 miles; and because the wind is N*b*E½E, and the ship can lie within 5½ points of the wind, the course on the larboard tack will be E*b*N, and on the starboard NW. Therefore, from the centre C draw the E*b*N line CB, and from it draw the NW line AB, meeting CB in B; then CB and AB applied to the scale will measure 26.7 and 48.1 m. respectively.

By Calculation.

In the triangle ACB, given AC = 40 miles, and the angles A, B, and C, equal to 3, 5, and 8 points respectively, to find AB and BC.

To find the distance CB.

As the sine of B	5 points	9.91985
is to the sine of A	3 points	9.74474
so is the distance CA	40 miles	1.60206
to the distance CB	26.73	1.42695

To find the distance AB.

As the sine of B	5 points	9.91985
is to the sine of C	8 points	10.00000
so is the distance CA	40 miles	1.60206
to the distance AB	48.11	1.68221

Example V. A ship close hauled within 5 points of the wind, and making one point of lee-way, is bound to a port bearing SSW, distant 54 miles, the wind being S*b*E: It is intended to make the port at three boards, the first of which must be on the larboard tack in order to avoid a reef of rocks. Required the course and distance on each tack?

By Construction.

Draw the SSW line CA (fig. 47.) equal to 54 m. and as the wind is S*b*E, and the ship makes her course good within 6 points of the wind, therefore the course on the larboard tack will be SW*b*W, and on the starboard E*b*S: hence from C draw the SW*b*W line CB, and from A draw AD parallel thereto; bisect CA in E, and draw BED parallel to the E*b*S line; then will CB and AD be the distances on the larboard tack, which applied to the scale, each will be found to measure 37.4; and the distance on the starboard tack BD will measure 42.4 miles.

Windward Sailing.

By Calculation.

The triangles CBE, EAD are equal and similar: hence in the first of these are given CE, equal to 27 miles, half the distance between the ship and port; the angles C, B, and E, equal to 3, 4, and 9 points respectively, to find CB and BE.

To find CB, the distance on the larboard tack.

As the sine of B	4 points	9.84948
is to the sine of E	9 points	9.99157
so is the distance CE	27 miles	1.43136
to the distance BC	37.45	1.57345

To find BE half the distance on the starboard tack.

As the sine of B	4 points	9.84948
is to the sine of C	3 points	9.74474
so is the distance CE	27 miles	1.43136
to the distance BE	21.21	1.32662
Whole distance AC	42.42	

Example VI. A ship plying to the windward, with the wind at NNE, after sailing 51 miles on each of two tacks, found by observation to have made 36 miles of difference of latitude. How near the wind did she make her way good?

By Construction.

Make CA (fig. 48.) equal to 36 miles; draw AB perpendicular to CA, and draw the NNE line CB, meeting AB in B; make CD, BD each equal to 51 miles; and these being measured, will be found equal to 6 points.

By Calculation.

In the triangles CAB, BCD, are given AB equal to 36 m. CD=BD=51, and the angle ACB equal to 2 points, to find the angle BCD.

As the distance CD	51	1.70757
is to the diff. of latitude CA	18	1.25527
so is the secant of ACB	2 points	10.03438
to the cosine of BCD	67° 32′	9.58208

Example VII. A ship that makes her way good within 6½ points of the wind, reaches her port on two boards; the first being on the larboard tack 25 miles, and the other on the starboard tack 38 miles; and the difference of latitude is 21 miles north. Required the bearing of the port, and direction of the wind?

By Construction.

With the given distances 25 and 38 miles, and the included angle equal to $16-2\times6\frac{1}{2}=3$ points, construct the triangle BCD (fig. 49.); hence CB will be known. Draw CA equal to 21 miles, the given difference of latitude; from A draw AB perpendicular to CA, and make CB equal to what it was before determined; make DE=DC, and draw the line CE, which will represent the direction of the wind, and the angle ACB is the bearing of the port: now ACE will be found equal to 52½, and ACB 18°.

By Calculation.

In the triangle BCD are given BC=25 m. BD=38 m. and the angle D=3 points, to find the angle BCD, and distance CB.

To

Windward Sailing.

To find the angle BCD.

Distance	BD=38	Angle BDC	33° 45′
———	BC=25		
		BCD+CBD	146 15
Sum	63	$\frac{BCD+CBD}{2}$	=73 7½
Difference	13		

As the sum of the sides	63	1.79934
is to the difference of the sides	13	1.11394
so is the tang. of half sum angles	73° 7½′	10.51806
to the tang. of half diff. angles	34 13½	9.83266
Angle BCD	107 21	

To find the distance BC.

As the sine of BCD	107° 21′	9.97978
is to the sine of BDC	33 45	9.74474
so is the distance BD	38	1.57978
to the distance BC	22.12	1.34474

To find the angle ACB, the bearing of the port.

As the distance BC	22.12	1.34474
is to the distance AC	21.	1.32222
so is radius		10.00000
to the cosine of ACB	18° 17′	9.97748
Angle BCD	107 21	
——ACD	125 38	
——DCE	73 7	
Direction of the wind	N 52 31 E	

CHAP X. *Of Current Sailing.*

THE computations in the preceding chapters have been performed upon the assumption that the water has no motion. This may no doubt answer tolerably well in those places where the ebbings and flowings are regular, as then the effect of the tide will be nearly counterbalanced. But in places where there is a constant current or setting of the sea towards the same point, an allowance for the change of the ship's place arising therefrom must be made: And the method of resolving these problems, in which the effect of a current, or heave of the sea, is taken into consideration, is called *current sailing*.

In a calm, it is evident a ship will be carried in the direction and with the velocity of the current. Hence, if a ship sails in the direction of the current, her rate will be augmented by the rate of the current; but in sailing directly against it, the distance made good will be equal to the difference between the ship's rate as given by the log and that of the current. And the absolute motion of the ship will be a-head, if her rate exceeds that of the current; but if less, the ship will make sternway. If the ship's course be oblique to the current, the distance made good in a given time will be represented by the third side of a triangle, whereof the distance given by the log, and the drift of the current in the same time, are the other sides; and the true course will be the angle contained between the meridian and the line actually described by the ship.

EXAMPLE I. A ship sailed NNE at the rate of 8 knots an hour, during 18 hours, in a current setting NW*b*W 2½ miles an hour—Required the course and distance made good?

Current Sailing.

Plate CCCXXXIX.

By Construction.

Draw the NNE-line CA (fig. 50). equal to 18×8 =144 miles; and from A draw AB parallel to the NW*b*W rhumb, and equal to 18×2½=45 miles: now BC being joined will be the distance, and NCB the course. The first of these will measure 159 miles, and the second 6° 23′.

By Calculation.

In the triangle ACB, are given AC=144 miles, AB=45 miles, and the angle CAB=9 points, to find BAC and BC.

To find the course made good.

Dist. AC	144	Ang. BAC=9 pts =	101° 15′
Dist. AB	45		
		B+C	78 45
Sum	189	$\frac{B+C}{2}$	39 22½
Diff.	99		

As the sum of the sides	189	2.27646
is to the difference of the sides	99	1.99563
so is the tan. of half sum angles	39 22½	9.91417
to the tan. of half diff. angles	23 15½	9.63334
Angle ACB	16 7	
Angle ACN	22 30	
Course made good	N 6 23 E	

To find the distance.

As the sine of ACB	16° 7′	9.44341
is to the sine of CAB	101 15	9.99157
so is the distance AB	45	1.65321
to the distance CB	159	2.20137

EXAMPLE II. A ship from a port in latitude 42° 52′ N, sailed S*b*W¼W 17 miles in 7 hours, in a current setting between the north and west; and then the same port bore ENE, and the ship's latitude by observation was 42° 42′ N. Required the setting and drift of the current?

By Construction.

Draw the S*b*W¼W line CA (fig. 51.) equal to 17 miles, and make CB equal to 10 miles, the difference of latitude: through B draw the parallel of latitude BD, and draw the WSW line CD, intersecting BD in D: AD being joined, will represent the drift of the current, which applied to the scale will measure 20.2, and the angle DAE will be its setting, and will be found equal to 72°.

By Calculation.

In the triangle CBD, given CB=10 miles, and the angle BCD=6 points; to find the distance CD.

As radius		10.00000
is to the secant of BCD	6 points	10.41710
so is the diff. of lat. CB	10 miles	1.00000
to the distance CD.	26.13	1.41710

Again, in the triangle ACD are given the distance AC=17 miles, CD=26.13, and the angle ACD 4½ points; to find the remaining parts.

To

urrent ailing.

Current Sailing.

To find the ſetting of the current.

Diſtance	DC=26.13	Angle ACD=4½ points.	
Diſtance	AC=17. 0	CAD+CDA 11½	
Sum -	43.13	CAD+CDA 5¾=64°41′	
Difference	9.13	2	
As the ſum of the ſides	43.13	-	1.63478
is to the difference of the ſides - -	9.13	-	0.96047
ſo is the tang. of half ſum angles -	64° 41′	-	10.32509
to the tang. of half diff. angles -	24 6	-	9.65078
Angle CAD -	88 47		
Angle CAE=ACB=1½pt.=	16 52		
Setting of the current EAD=	71 55		

To find the drift of the current.

As the ſine of CAD -	88° 47′	-	9.99990
is to the ſine of ACD	4½ points		9.88819
ſo is the diſtance CD -	26.13	-	1.41710
to the drift of currt. AD	20.2	-	1.30539

Hence the hourly rate of the current is $\frac{20.2}{7}=2.9$ knots.

Example III. A ſhip, from latitude 38° 20′ N, ſailed 24 hours in a current ſetting NW*b*N, and by account is in latitude 38° 42′ N, having made 44 miles of eaſting; but the latitude by obſervation is 38° 58′ N. Required the courſe and diſtance made good, and the drift of the current?

By Conſtruction.

Plate CCXXXIX.

Make CE (fig. 52.) equal to 22 miles, the difference of latitude by D, R, and EA=44 miles, the departure, and join CA; make CD=38 miles, the difference of latitude by obſervation; draw the parallel of latitude DB, and from A draw the NW*b*N line AB, interſecting DB in B, and AB will be the drift of the current in 24 hours; CB being joined, will be the diſtance made good, and the angle DCB the true courſe. Now, AB and CB applied to the ſcale, will meaſure 19.2 and 50.5 reſpectively; and the angle DCB will be 41°¼.

By Calculation.

From B draw BF perpendicular to AE, then in the triangle AFB are given BF=16 miles, and the angle ABF=3 points; to find AB and AF.

To find the drift of the current AB.

As radius	-	-	10.00000
is to the ſecant of ABF	3 points	-	10.08015
ſo is BF - -	16 miles		1.20412
to the drift of the current AB	19.24	-	1.28427

Hence the hourly rate $=\frac{19.24}{24}=0.8$.

To find AF.

As radius	-	-	10.00000
is to the tangent of ABF -	3 points		9.82489
ſo is BF - -	16	-	1.20412
to AF - -	10.69		1.02901
Departure by account EA	44.		
True departure	EF=DB=33.31		

Now, in the triangle CDB are given the difference of latitude and departure; to find the courſe and diſtance.

To find the courſe.

As the difference of latitude CD	38.	1.57978
is to the departure DB -	33.31	1.52257
ſo is radius - -		10.00000
to the tangent of the courſe	41° 14′	9.94279

To find the diſtance.

As radius - -		10.00000
is to the ſecant of the courſe	41° 14′	10.12376
ſo is the difference of latitude	38	1.57978
to the diſtance - -	50.53	1.70354

Example IV. In the Straits of Sunda, at 2 P. M. ſteering SE*b*S at the rate of 5 knots an hour, I paſſed cloſe by the SE of the ſmall iſlands off Hog point. At 6, not having changed our courſe, came to anchor on the Java ſhore. Upon ſetting the ſaid iſland from this anchoring place, I find it bears due north, its diſtance by the chart being 22 miles. It follows from hence, that our courſe has been affected by a current. Required its velocity and direction?

By Conſtruction.

From A (fig. 53.) draw the SE*b*S line AB=20, which will repreſent the ſhip's apparent tract through the water; draw AC equal to 22 miles ſouth, and C will be the ſhip's real place; and BC being joined will be the current's drift in four hours; which applied to the ſcale will meaſure 12.3: from A draw AD parallel to BC, and the angle CAD will be the direction of the current, and will be found to meaſure 64°⅕.

By Calculation.

In the triangle ABC, given AB=20 m. AC=22 m. and the included angle A=3 points; to find the remaining parts.

To find the ſetting of the current.

Diſtance AC=22 m. Included angle = 3 points.

—— AB=20		B+C=13	
Sum -	42	$\frac{B+C}{2}=6\frac{1}{2}p=73.7\frac{1}{2}$	
Difference	2		
As the ſum of the ſides		42 -	1.62325
is to the difference of the ſides -		2 -	0.30103
ſo is the tangent of half ſum angles		73° 7′½ -	10.51806
to the tangent of half diff. angles		8. 55¼ -	9.19584

Setting of the current S 64 12 W, or SW*b*W¾W.

To find the drift of the current.

As the ſine of ACB -	64° 12′		9.95440
is to the ſine of BAC	33 45	-	9.74474
ſo is the diſtance AB	20	-	1.30103
to the velocity of current BC -	12 34	-	1.09137

and $\frac{12.34}{4}=3.1$, its hourly rate.

Example V. A ſhip bound from Dover to Calais, lying

Current Sailing.

lying 21 miles to the SE*b*E½E, and the flood tide setting NE½E 2½ miles an hour. Required the course she must steer, and the distance run by the log at 6 knots an hour to reach her port?

By Construction.

Plate cccxxxix.

In the position of the SE*b*E½E rhumb, draw DC =21 miles (fig. 54.); draw DE NE½E=2½ miles; from E with 6 miles cut DC in F; draw DB parallel to EF, meeting CB drawn parallel to DE: then the distance DB applied to the scale will measure 19.4, and the course SDB will be SE½S.

By Calculation.

In the triangle DBF, given DE=2½ miles, EF =6 miles, and the angle EDF=6 points; to find the angle DFE=CBD.

As the hourly rate of sailing	6 m.	0.77815
is to the hourly rate of the current	2½ m. -	0.39794
so is the sine of EDF=6 points -	67° 30′	9.96562
to the sine of DFE -	22 38	9.58541
Angle - SDC=5½ points =	61 52	
Course SDB - -	39 14=SE½S.	

In the triangle DBC, given DC=21 miles, the angle BDC=DFE=22° 38′, and the angle DCB= DEF=6 points; to find the distance DB.

As the sine of DBC -	89° 52′ -	9.99999
is to the sine of DCB -	67 30 -	9.96562
so is the true distance DC	21 m.	1.32222
to the distance by the log DB.	19.4 m.	1.28785

Example VI. A ship at sea in the night has sight of Scilly light, bearing NE*b*N, distant 4 leagues, it being then flood tide, setting ENE 2 miles an hour. What course and distance must the ship sail to make the Lizard, which bears from Scilly E½S, distance 17 leagues?

By Construction.

Draw the NE*b*N line AS=12 miles (fig. 55.); hence S will represent Scilly; from S draw SL=51 miles, and parallel to the E½S rhumb, then L will represent the Lizard; draw LC parallel to the ENE rhumb, and equal to 2 miles, and make CD=5 miles; from A draw AB parallel to CD, meeting LC produced in B; then AB will be the distance, and the angle SAB the course: the first of these applied to the scale will measure 41.9 miles, and the course will be S 88° E.

By Calculation.

In the triangle SAL are given the sides AS, SL =12 and 51 miles respectively, and the angle ASL =10½ points; to find the other parts.

To find the angles.

Distance SL=51 m.	Angle ASL=10½ points.		
——— AS=12 m.	SAL+SLA= 5½		
Sum - 63 m.	$\frac{SAL+SLA}{2}$ = 2¾=30°56′		
Difference 39 m.			
As the sum of the sides	63	-	1.79934
is to the diff. of the sides	39	-	1.59106
so is the tangent of half sum angles -	30° 56′	-	9.77763
to the tang. of half their difference -	20 21	-	9.56935
Angle SAL -	= 51 17		

NAS=3 points	33 45
NAL - -	85 2
LAE=FLA	4 58
FLB=2 points	22 30
ALB=DLC -	17 32

To find the distance AL.

As the sine of SAL -	51° 17′ -	9.89223
is to the sine of ASL	10½ points	9.94543
so is the distance SL -	51 miles	1.70757
to the distance AL -	57.64 -	1.76077

Again, in the triangle DLC, are given the side DC=5 miles, the ship's run in an hour; LC=2 miles, the current's drift in the same time; and the angle DLC=17° 32′; to find the angle LDC=LAB.

As the dist. -	DC=5 miles -	0.69897
is to the distance	LC=2 miles -	0.30103
so is the sine of	DLC=17° 32′ -	9.47894
to the sine of - LDC	6 55 -	9.08100
Angle NAL - -	85 2	
NAB -	91 57	
Course - -	S 88 3 E	

In the triangle ABL, the side AL, together with the angles, are given, to find the distance AB.

As the sine of ABL -	155° 33′ -	9.61689
is to the sine of ALB	17 32 -	9.47894
so is the distance AL	57.64	1.76077
to the distance AB -	41.96	1.62282

Instruments to solve Problems in Sailing independent of Calculation.

Chap. XI. *Instruments proposed to solve the various Problems in Sailing, independent of Calculation.*

Various methods, beside those already given, have been proposed to save the trouble of calculation.—One of these methods is by means of an instrument composed of rulers, so disposed as to form a right-angled triangle, having numbers in a regular progression marked on their sides. These instruments are made of different materials, such as paper, wood, brass, &c. and are differently constructed, according to the fancy of the inventor. Among instruments of this kind, that by John Cooke, Esq; seems to be the best. A number of other instruments, very differently constructed, have been proposed for the same purpose; of these, however, we shall only take notice of the rectangular instrument, by And. Mackay, A. M. F. R. S. E.

I. *Of* Cooke's *Triangular Instrument.*

Description. The stock *a b c d* (fig. 56.) is a parallelopiped: The length from *a* to *b* is two feet, the breadth from *a* to *d* two inches, and the depth is one inch and a half. The stock is perforated longitudinally, so as to be capable of containing within it *e f*, a cylindrical piece of wood one inch diameter; *g h* is an aperture on the surface of the stock about a quarter of an inch wide, which discloses one-twelfth part of

Instruments to solve Problems in Sailing, independent of Calculation.

of the surface of the cylinder contained; the edge dc is divided into twelve parts, each of these is subdivided into six parts, and each of these again into ten parts. The surface of the cylinder is divided longitudinally into twelve parts, and on each of them is engraved a portion of a line of meridional parts 22 feet long, which contains the meridional parts for every minute from the equator as far towards the pole as navigation is practicable; and the smallest division on it is not less than $\frac{1}{20}$th of an inch. By rolling and sliding this cylinder, any part of any line on it may be brought into any position which may be required: the box i is engrooved into the edge of the stock ab, so that it may move freely from a to b; a limb from this box extends to k, which serves to mark that degree of the perpendicular il which is parallel to the centre of the semicircle m; il is two feet long, and graduated on both edges as the stock; it is perpendicular to the stock, and is fixed in the box i, by which it may be moved from a to b; opn is a semicircle of six inches radius, engraved, as appears in the plate, which slides freely from c to d in a groove in the edge of the stock cd; mq is the index moving on the centre m, the edge of which marks the course on the semicircle; it is two feet long, and divided into 72 parts; and these are subdivided in the same manner as those on the stock and perpendicular, to which they are equal; r is a vernier attached to the index to show minutes; S is a vernier composed of concentric semicircles, which slides along the edge qm, to the intersection of the perpendicular and index, where it serves as a vernier to both; below x is a small piece of ivory, with a mark on it to point out the degree of the line dc, which is perpendicularly under the centre of the semicircle. Fig. 57. is a view of the back part of the instrument.

Plate cccxxxix.

Use. The method of working every case which occurs in navigation, is to make the instrument similar to that ideal triangle which is composed of the difference of latitude, departure, and distance; or, to that composed of the meridional difference of latitude, difference of longitude, and enlarged distance; or, to that composed of the difference of longitude, departure, and sine, of the middle latitude; which is done by means of the data procured from the compass, log-line, and quadrant: whence it follows, from the nature of similar triangles, or from the relation which exists between the sides of triangles and the sines of their opposite angles, that the parts of the instrument become proportional to those which they represent; and will ascertain the length of the lines, or the extent of the angles sought, by its graduations.

In the practice of this instrument, a small square is necessary, in order to bring the centre of the semicircle perpendicularly over the meridional degree corresponding to the latitude.

Plane Sailing.

Prob. I. The course and distance sailed being given, to find the difference of latitude and departure.

Example. A ship from latitude 24° 18′ N sailed NW b N 168 miles. Required the latitude come to, and departure?

Set the centre of the semicircle perpendicularly over the given latitude 24° 18′, and the index to the course 3 points; move the perpendicular until it cut the index at the given distance 168; then at the point of intersection on the perpendicular is 93.3 miles, the departure, and on the base, by the edge of the box, is 26° 38′, the latitude come to.

Prob. II. Both latitudes and course given, to find the distance and departure.

Example. Let the latitude sailed from be 43° 50′ N, that come to 47° 8′ N, and the course NNE. Required the distance and departure?

Move the centre of the semicircle to the latitude left 43° 50′, and the edge of the box to the latitude come to 47° 8′; fix the index at the given course 2 points: then at the point of intersection of the index and perpendicular is the distance 214 miles on the index, and the departure 82 miles on the perpendicular.

Prob. III. Given the course and departure, to find the distance and difference of latitude.

Example. Let the latitude sailed from be 32°38′ N, the course SWbS, and the departure 200 miles. Required the distance and latitude come to?

Move the centre of the semicircle to the latitude left 32° 38′, set the index to the given course 3 points, and move the perpendicular till the given departure 200 cuts the index; at this point on the index is 360 miles, and the edge of the box will cut the latitude come to 27° 39′ N.

Prob. IV. Given the difference of latitude and distance, to find the course and departure.

Example. Let the latitude left be 17° 10′ N, the latitude come to 21° 40′ N, and the distance sailed on a direct course between the north and west 300 miles. Required the course and departure?

Move the semicircle and box to the given latitudes, and the index until the distance found thereon meets the perpendicular, then at the point of contact on the perpendicular is 130.8, the departure, and on the semicircle by the index is 25° 50′, the course.

Prob. V. The distance and departure given, to find the course and difference of latitude.

Example. The distance sailed is 246 miles between the south and east, the departure is 138 miles, and the latitude left 51° 10′ N. Required the course and latitude come to?

Set the centre of the semicircle to 51° 10′, the latitude sailed from; find the distance 246 on the index, and the departure 138 on the perpendicular; then move both till these points meet, and the course 34° 10′ will be found on the semicircle by the index, and the latitude in, 47° 47′ N, by the edge of the box.

Prob. VI. Both latitudes and departure given, to find the course and distance.

Example. A ship from latitude 43° 10′ N, sailed between the north and west till she is in latitude 47° 14′ N, and has made 170 miles of departure. Required the course and distance?

Move the centre of the semicircle over 43° 10′, and the edge of the box to 47° 14′; find the departure on the perpendicular, and bring the edge of the index thereto; now at the point of intersection is the distance 297.4 miles on the index, and the course 34° 52′ on the semicircle.

Traverse Sailing.

Example. A ship from latitude 46 48′ N sailed

Instrument to solve Problems in Sailing, independent of Calculation.

ed SSW½W 24 miles, S*b*W 36 miles, and S½E 40 miles. Required the latitude in, together with the direct course and distance?

Set the semicircle to the latitude sailed from 46° 48′, and the index to the course SSW½W, mark the distance 24 on the index, and bring the perpendicular to meet it; then the index will cut the departure 11.3 on the perpendicular, and the perpendicular will cut the latitude 46° 27′ N on the base. For the next course and distance, bring the semicircle to the latitude marked by the perpendicular, and lay down the course S*b*W: if it be towards the first meridian, move the last marked departure until it meets the index, and the limb of the box will mark the present departure; but if the course be from the first meridian, bring the last departure 11.3 to the limb of the box, the index will mark the departure made good 18.3 on the perpendicular, and the latitude arrived at 45° 52′ will be marked on the base by the perpendicular: proceed in the same manner with all the courses of which the traverse consists, then the difference of latitude 1° 36′ will be intercepted between the latitude sailed from 46° 48′, and the latitude come to 45° 12′, last marked by the perpendicular; and also the departure made good will be intercepted between that point on the perpendicular where the first departure commenced, and that where the last terminated. Now, with the difference of latitude 1° 36′ and the departure, the course will be S 8° 30′ W, and distance 97 miles, by last problem in Plane Sailing.

Parallel Sailing.

Prob. I. The difference of longitude between two places in one parallel of latitude given, to find the distance between them.

Example. Let the common latitude be 49° 30′ N, and the difference of longitude 3° 30′. Required the distance?

Set the index to 40° 30′, the complement of the latitude on the semicircle; mark the difference of longitude in miles on the index; then move the perpendicular until it meets the termination of the difference of longitude on the index, and the part of the perpendicular intercepted between the limb of the box and the point of intersection will be the distance 136 4 miles.

Prob. II. The distance between two places in one parallel of latitude given, to find the difference of longitude between them.

Example. Let the latitude of the given parallel be 49° 30′ N, the distance sailed 136.4 E. Required the difference of longitude?

Set the index to the complement of the latitude 40° 30′, and mark the distance sailed on the perpendicular; then move it until it meets the index, and the point of intersection will show the difference of longitude 210′ or 3°30′ on the index.

Prob. III. Given the distance sailed on a parallel, and the difference of longitude, to find the latitude of that parallel.

Example. The distance sailed due east is 136.4, and the difference of longitude 3° 30′. Required the latitude of the parallel?

Find the difference of longitude 210 on the index, and the distance 136.4 on the perpendicular, and move both until these numbers meet, and the complement of the latitude 40° 30′ will be shown by the index on the semicircle.

Mercator's and Middle Latitude Sailing.

Prob. I. The latitudes and longitudes of two places given, to find the direct course and distance between them.

Example. Required the course and distance between two places whose latitudes and longitudes are 50° 50′ N, 19° 0′ W, and 54° 30′ N, 15° 30′ W, respectively?

By Mercator's Sailing.

To find the course.

Move the centre of the semicircle perpendicularly over the meridional degree answering to latitude 50° 50′ N, then move the box until the edge of the perpendicular cuts the meridional parts of the other latitude 54° 30′ N, and move the index until it cuts the difference of longitude 3° 30′ on the perpendicular, and the index will mark the course 30° 10′, or NNE¾E nearly, on the semicircle.

To find the distance.

Screw the index to this course, and move the centre of the semicircle to the latitude 50° 50′ N, and the edge of the perpendicular to the latitude 54° 30′ N, then the perpendicular will cut the distance 254.7 on the index.

By Middle Latitude Sailing.

To find the departure.

Move the centre of the semicircle to the latitude 50° 50′, and the edge of the index to the complement of the middle latitude 37° 20′ on the semicircle; then move the box until the edge of the perpendicular intersects the termination of the difference of longitude 210 miles on the index, which point of intersection will mark the departure 128 on the perpendicular.

To find the course and distance.

Move the edge of the perpendicular to the other latitude 54° 30′, and the index until it cuts the departure 128 on the perpendicular; then will the perpendicular mark the distance on the index 254.7 miles, and the index will mark the course on the semicircle 30° 10′, or NNE¾E nearly.

Prob. II. Both latitudes and course given, to find the distance and difference of longitude.

Example. A ship from latitude 50° 50′ N, longitude 19° 0′ W, sailed N 30° 10′ E, until she is in latitude 54° 30′ N. Required the distance and difference of longitude?

By Mercator's Sailing.

To find the difference of longitude.

Move the box and semicircle as in the former problem to the meridional parts of the given latitudes, then set the index to the course, and it will mark the difference of longitude 3° 30′ on the perpendicular: Hence the longitude in is 15° 30′ W.

To find the distance.

Move the perpendicular and semicircle to the given latitudes, and put the index to the given course; then the perpendicular will cut the distance 254.7 miles on the index.

By Middle Latitude Sailing.

To find the distance and departure.

Move the semicircle and perpendicular to the given atitudes, and the index to the course; then the perpendicular will show the departure 128 miles, and the

ftruments folve oblems Sailing, depen- nt of Cal ulation.

the index the diftance 254.7 miles at the point of interfection.

To find the difference of longitude.

Set the index to the complement of the middle latitude on the femicircle, and move the box until the termination of the departure on the perpendicular meets the index, which will mark the difference of longitude thereon 210 m. or 3° 30′.

Prob. III. Both latitudes and diftance given, to find the courfe and difference of longitude.

Example. From latitude 50° 50′ N, longitude 19° 0′ W, a fhip failed 254.7 miles between the north and eaft, and by obfervation is in latitude 54° 30′ N. Required the courfe and difference of longitude?

By Mercator's Sailing.

To find the courfe.

Move the perpendicular and femicircle to the given latitudes, and the index until the diftance failed marked on it meets the perpendicular; then the index will mark the courfe N 30° 10′ E on the femicircle.

To find the difference of longitude.

Screw the index to the courfe, move the perpendicular and femicircle to the meridional parts of the given latitudes, and the fpace intercepted between the limb of the box and the index will be the difference of longitude 3° 30′.

By Middle Latitude Sailing.

To find the departure and courfe.

Move the femicircle and perpendicular to the given latitudes, and the index until the diftance failed on it cuts the perpendicular; then the perpendicular will fhow the departure 128 miles, and the femicircle the courfe N 30° 10′ E.

To find the difference of longitude.

Set the index to 37° 20′, the complement of the middle latitude on the femicircle, and move the perpendicular until the termination of the departure on it cuts the index; then the point of interfection will mark the difference of longitude 210 miles on the index.

Prob. IV. Both latitudes and departure given, to find the courfe, diftance, and difference of longitude.

Example. Let the latitude and longitude failed from be 56° 40′ S and 28° 55′ E refpectively, the latitude come to 61° 20′ S, and departure 172 miles. Required the courfe, diftance, and difference of longitude?

By Mercator's Sailing.

To find the courfe and diftance.

Move the perpendicular and femicircle to the given latitudes (H); then move the index till it meets the extremity of the departure on the perpendicular; the diftance will be marked on the index 329, and the courfe S 31° 35′ E or SSE¾E nearly on the femicircle.

To find the difference of longitude.

Move the perpendicular and femicircle to the meridional parts of the given latitudes, and the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The courfe and diftance are found as before.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the femicircle, and move the perpendicular until the departure marked on it cuts the index, and this point of interfection will mark the difference of longitude on the index 335 m. or 5° 35′.

Inftruments to folve Problems in Sailing, independent of Calculation.

Prob. V. One latitude, courfe, and diftance given, to find the difference of latitude and difference of longitude.

Example. Let the latitude left be 56° 40′ S, longitude 28° 55′ E, the courfe S 31° 35′ E, and diftance 329 m. Required the latitude and longitude come to?

By Mercator's Sailing.

To find the latitude come to.

Set the femicircle to the latitude failed from, and the index to the courfe, and bring the perpendicular to the diftance, which at the fame time will mark the latitude come to 61° 20′ S.

To find the difference of longitude.

Screw the index to the courfe, and move the femicircle and perpendicular to the meridional parts of both latitudes; then the index will cut the difference of longitude on the perpendicular 5° 35′.

By Middle Latitude Sailing.

The latitude arrived at is found as above.

To find the departure.

The femicircle and perpendicular being fet to both latitudes, and the index to the courfe, it will fhow the departure 172.7 on the perpendicular.

To find the difference of longitude.

Set the index to 31°, the complement of the middle latitude on the femicircle, and move the perpendicular until the departure marked on it cuts the index, and the divifion on the index at the point of interfection will be the difference of longitude 335.

Prob. VI. One latitude, courfe, and departure given, to find the diftance, difference of latitude, and difference of longitude.

Example. Let the latitude failed from be 56° 40′ N, longitude 28° 35′ W, the courfe N 31° 35′ W, and departure 172.7. Required the diftance, and the latitude and longitude come to?

By Mercator's Sailing.

To find the diftance and latitude come to.

Move the femicircle to the latitude left, and the index to the courfe; mark the departure on the perpendicular, and move it until the termination thereof meets the index; then the point of interfection will fhow the diftance 329 miles on the index, and the perpendicular will fhow the latitude arrived at 61° 20′ N on the bafe.

To find the difference of longitude.

Screw the index, and move the perpendicular and femicircle to the meridional parts of both latitudes, then the index will cut the difference of longitude 5° 35′ on the perpendicular.

By Middle Latitude Sailing.

Find the diftance failed and latitude in as above, and

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(H) In fouthern latitudes, the end of the cylinder where the numbers begin muft be turned towards the north, pointed out by the femicircle; and in northern latitudes, it muft be reverfed.

Instrument to solve Problems in Sailing, independent of Calculation.

and the difference of longitude as in Problem IV. by middle latitude sailing.

PROB. VII. One latitude, the distance sailed, and departure given, to find the course, difference of latitude, and difference of longitude.

EXAMPLE. The latitude sailed from is 48° 30′ N, and longitude 14° 40′ W, the distance run is 345 miles between the south and east, and the departure 200 miles. Required the course, and the latitude and longitude come to?

By Mercator's Sailing.

To find the course and latitude come to.

Move the semicircle to the latitude left, mark the distance on the index, and the departure on the perpendicular, move both until these points meet; then will the index show the course S 35° 26′ E on the semicircle, and the latitude come to 43° 49′ on the base.

The difference of longitude is found as in the preceding problem.

By Middle Latitude Sailing.

The course and latitude come to are found as above, and the difference of longitude as in Problem IV. by middle latitude sailing.

Plate CCCXL.

II. *Of* MACKAY's *Rectangular Instrument.*

Description. Fig. 58. is a representation of this instrument, of about one-third of the original size.—The length CA is divided into 100 equal parts, and the breadth CB into 70; but in this plate every second division only is marked, in order to avoid confusion; through these divisions parallels are drawn, terminating at the opposite sides of the instrument. Upon the upper and right-hand sides are two scales; the first contains the degrees of the quadrant, and the other the points and quarters of the compass. M is an index moveable about the centre C, and divided in the same manner as the sides (1). Fig. 59. is a portion of the enlarged meridian, so constructed that the first degree is equal to three divisions on the instrument; and therefore, in the use of this line, each division on the instrument is to be accounted 20 minutes. The size of the plate would not admit of the continuation of the line.

Use. From a bare inspection of this instrument, it is evident that any triangle whatever may be formed on it. In applying it to nautical problems, the course is to be found at top, or right-hand side, in the column of degrees or points, according as it is expressed; the distance is to be found on the index, the difference of latitude at either side column, and the departure at the head or foot of the instrument. The numbers in these columns may represent miles, leagues, &c.; but when used in conjunction with the enlarged meridional line, then 10 is to be accounted 100 miles, 20 is to be esteemed 200 miles, and so on, each number being increased in a tenfold ratio; and the intermediate numbers are to be reckoned accordingly.

Plane Sailing.

PROB. I. The course and distance sailed given, to find the difference of latitude and departure.

EXAMPLE. Let the course be NE ½ N, distance 44 miles. Required the difference of latitude and departure?

Move the index until the graduated edge be over 3½ points, and find the given distance 44 miles on the index: this distance will be found to cut the parallel of 34 miles, the difference of latitude in the side column, and that of 28 miles, the departure at the top.

PROB. II. Given the course and difference of latitude; to find the distance and departure.

EXAMPLE. Required the distance and departure answering to the course 28°, and difference of latitude 60 miles?

Lay the index over the given course 28°; find the difference of latitude 60 miles in the side column; its parallel will cut the index at 68 miles, the distance and the corresponding departure at the top is 32 miles.

PROB. III. The course and departure given, to find the distance and difference of latitude.

EXAMPLE. Let the course be SSW. and the departure 36 miles. Required the distance and difference of latitude?

Lay the index over two points; find the departure at the top, and its parallel will cut the index at 94 miles the distance, and the difference of latitude on the side column is 87 miles.

PROB. IV. Given the distance and difference of latitude, to find the course and departure.

EXAMPLE. The distance is 35 leagues, and the difference of latitude 30 leagues. Required the course and departure?

Bring 35 leagues on the index to the parallel of 30 leagues in the side; then the departure at the top is 18 leagues and the course by the edge of the index on the line of rhumbs is 2¼ points.

PROB. V. Given the distance and departure, to find the course and difference of latitude.

EXAMPLE. Let the distance be 58 miles, and the departure 15 miles. Required the course and difference of latitude?

Move the index until 58 found thereon cuts the parallel of 15 from the top: this will be found to intersect the parallel of 56 miles, the difference of latitude; and the course by the edge of the ruler is 15°.

PROB. VI. The difference of latitude and departure being given, to find the course and distance.

EXAMPLE. Let the difference of latitude be 30 miles, the departure 28 miles. Required the course and distance?

Bring the index to the intersection of the parallels of 30 and 28; then the distance on the index is 41 miles, and the course by its edge is 43°.

Traverse Sailing.

Find the difference of latitude and departure answering to each course and distance by Problem I. of Plane Sailing, and from thence find the difference of latitude and departure made good; with which find the course and distance by the last problem.

An example is unnecessary.

Parallel

(1) In the original instrument are two slips, divided like the side and end of the instrument. One of these slips is moveable in a direction parallel to the side of the instrument, and the other parallel to the end.

ftruments to folve Problems in Sailing, indepen-dent of Calculation.

Parallel Sailing.

Prob. I. Given the difference of longitude between two places on the fame parallel, to find the diftance between them.

Example. Let the latitude of a parallel be 48°, and the difference of longitude between two places on it 3° 40′, required their diftance?

Put the index to 48°, the given latitude, and find the difference of longitude 220 on the index, and the correfponding parallel from the fide will be 147, the diftance required.

Prob. II. The latitude of a parallel, and the diftance between two places on that parallel, being given, to find the difference of longitude between them.

Example. The latitude of a parallel is 56°, and the diftance between two places on it 200 miles. Required their difference of longitude?

Put the index to the given latitude, and find the diftance in the fide column, and the interfection of its parallel with the index will give 358, the difference of longitude fought.

Prob. III. Given the diftance and difference of longitude between two places on the fame parallel, to find the latitude of that parallel.

Example. The number of miles in a degree of longitude is 46.5. Required the latitude of the parallel?

Bring 60 on the index to cut the parallel of 46.5 from the fide, then the edge of the index will give 39° 11′, the latitude required.

Middle Latitude and Mercator's Sailing.

Prob. I. The latitudes and longitudes of two places being given, to find the courfe and diftance between them

Example. Required the courfe and diftance between Genoa, in latitude 44°25′N, longitude 8°36′E, and Palermo, in latitude 38° 10′N, longitude 13° 38′E.?

By Mercator's Sailing.

Take the interval between 38° 10′ and 44° 25′ on the enlarged meridian, which laid off from C upwards will reach to 500; now find the difference of longitude 302 at the top, and bring the divided edge of the index to the interfection of the correfponding parallels, and the index will fhow the courfe 31° 8′ on the line of degrees; then find the difference of latitude 375 on the fide column, and its parallel will interfect the index at 438, the diftance.

By Middle Latitude Sailing.

Put the index to 41° 18′, the complement of the middle latitude on degrees, and the difference of longitude 302 on the index will interfect the parallel of 227, the departure, in the fide column. Now move the index to the interfection of the parallels of 375 and 227, the firft being found in the fide column, and the other at top or bottom; then the diftance anfwering thereto on the index will be 438, and the courfe on the fcale of degrees is 41° 10′.

Prob. II. Given one latitude, courfe, and diftance, to find the other latitude and difference of longitude.

Example. Let the latitude and longitude failed from be 39° 22′N. and 12° 8′W. refpectively, the courfe NNW ½ W. and diftance 500 miles. Required the latitude and longitude come to?

By Mercator's Sailing.

Put the index to the courfe 2½ points, and find the diftance 500 miles thereon; then the correfponding difference of latitude will be 441 miles, and the departure 235½ miles: hence the latitude in is 46°43 N. Now take the interval between the latitudes of 39° 22′ and 46° 43′ on the enlarged meridian, which laid off from C will reach to about 605, the parallel of which will interfect the vertical parallel of the difference of longitude 323 at the edge of the index: hence the longitude in is 17° 31′W.

By Middle Latitude Sailing.

Find the difference of latitude and departure as before, and hence the latitude in is 46° 43′ N, and the middle latitude 43° 3′. Now put the index to 43° 3′, and the horizontal parallel of the departure 235½ will interfect the index at 322, the difference of longitude.

Prob. III. Both latitudes and courfe given, to find the diftance and difference of longitude.

Example. The latitude failed from is 22° 54′S, and longitude 42° 40′W, the courfe is SE by E, and latitude come to 26° 8′S. Required the diftance failed, and longitude in?

By Mercator's Sailing.

Bring the index to 5 points, the given courfe, and the parallel of 194, the difference of latitude found in the fide column will interfect the index at 349, the diftance; and it will cut the vertical parallel of 290, the departure.

Take the interval between the given latitudes 22° 54′ and 26° 8′ on the enlarged meridian; lay off that extent from the centre on the fide column, and it will reach to 213: the parallel of this number will interfect the vertical parallel of 319, the difference of longitude. Hence the longitude in is 37° 21′W.

By Middle Latitude Sailing.

With the given courfe and difference of latitude find the diftance and departure as before; then bring the index to the middle latitude 24° 31′; find the departure 290 in the fide column, and its parallel will interfect the index at 319, the difference of longitude.

Prob. IV. One latitude, courfe, and departure, given, to find the other latitude, diftance, and difference of longitude.

Example. The latitude and longitude left are 20° 30′N. and 49° 17′W. refpectively; the courfe is NE ¼ N, and departure 212 miles. Required the latitude and longitude come to, and diftance failed?

By Mercator's Sailing.

Put the index to the given courfe 3¾ points, and the vertical parallel of 212 will cut the index at 356, the diftance, and the horizontal parallel of 286, the difference of latitude; the latitude come to is therefore 25° 16′N.

Now take the interval between the latitudes 20° 30′, and 25° 16′ on the enlarged meridian, which laid off from the centre C will reach to 311; and this parallel will interfect the vertical parallel of the difference of longitude 230, at the edge of the index. Hence the longitude in is 45° 27′W.

By Middle Latitude Sailing.

Find the diftance and difference of latitude as directed above; then bring the index to 22° 53′, the middle latitude, and the horizontal parallel of 212, the departure,

Instruments to solve Problems in Sailing, independent of Calculation.

parture, will interfect the index at 230, the difference of longitude.

Prob. V. Both latitudes and diftance given, to find the courfe and difference of longitude.

Example. The diftance failed is 500 miles between the north and weft; the latitude and longitude left are 40° 10′N, and 9° 20′W. refpectively, and the latitude in is 46° 40′N. Required the courfe and longitude in?

By Mercator's Sailing.

Bring the diftance 500 on the index to interfect the horizontal parallel of the difference of latitude 390; then the courfe 38° 44′ is found on the line of degrees by the edge of the index, and the vertical parallel of the above point of interfection is that anfwering to 313, the departure.

Take the interval between the latitudes 40° 10′, and 46° 40′, which lay off from the centre C, and its horizontal parallel will interfect the vertical parallel of 431, the difference of longitude, by the edge of the index, it being in the fame pofition as before. Hence the longitude in is 16° 31′W.

By Middle Latitude Sailing.

The courfe and departure are found as formerly, and the middle latitude is 43° 25′, to which bring the edge of the index, and the horizontal parallel of 313, the departure, will interfect the index at 431, the difference of longitude.

Prob. VI. Both latitudes and departure given, to find the courfe, diftance, and difference of longitude.

Example Let the latitude failed from be 42° 52′N. long. 9° 17′W, the departure 250 miles W, and the latitude come to 36° 18′N. Required the courfe and diftance failed, and the longitude come to?

By Mercator's Sailing.

Find the point of interfection of the horizontal parallel of 394, the difference of latitude, and the vertical parallel of 250, the departure; to this point bring the index, and the correfponding divifion thereon will be 467 miles, and the courfe on the fcale of degrees by the edge of the index will be 32° 24′.

Take the interval between the latitudes on the enlarged meridian; which being laid off from the centre will reach to 512: now the horizontal parallel of 512 will cut the vertical parallel of 325, the difference of longitude, at the edge of the index. The longitude come to is therefore 14° 42′ W.

By Middle Latitude Sailing.

The courfe and diftance are to be found in the fame manner as above. Then bring the index to 39° 35′, the middle latitude, and the horizontal parallel of 250 will interfect the edge of the index at 324½, the difference of longitude.

Prob. VII. Given one latitude, diftance, and departure, to find the other latitude, courfe, and difference of longitude.

Example. A fhip from latitude 32° 38′ N. longitude 17° 6′ W. failed 586 miles between the fouth and weft, and made 336 miles of departure:—Required the courfe, and the latitude and longitude come to?

Great Circle Sailing.

By Mercator's Sailing.

Move the index till the diftance 586 interfects the vertical parallel of the departure 336; then the correfponding horizontal parallel will be 480, the difference of latitude, and the courfe 35°. Hence the latitude in is 24° 38′ N.

Now take the interval between the latitudes on the enlarged meridian, which laid off from the centre will reach to 547, the horizontal parallel of which will cut the vertical parallel of 383, the difference of longitude. The longitude in is therefore 23° 29′ W.

By Middle Latitude Sailing.

Find the courfe and difference of latitude as before, and hence the middle latitude is 28° 38′, to which bring the index, and the horizontal parallel of 336, the departure, will interfect the index at 383, the difference of longitude.

It feems unneceffary to enlarge any further on the ufe of this inftrument, as the above will make it fufficiently underftood.

Chap. XII. *Of Great Circle Sailing.*

The application of fpherical trigonometry to the folution of triangles formed upon the furface of the earth, is called *Great Circle Sailing.*

The earth being fuppofed an exact fphere, the fhorteft diftance between two places is the arch of a great circle intercepted between them; and therefore the diftance failed upon a direct courfe from one place to another, will always be longer than the arch of a great circle contained between them, except when the rhumb line coincides with a great circle, which can only happen when the fhip fails on a meridian or on the equator.

Although it is impoffible to make a fhip defcribe an arch of a great circle, yet fhe may be kept fo near it as to make the error almoft infenfible.

The terms that enter into this failing are, the latitudes of the places, their difference of longitude and diftance, and the angles contained between the diftance and the meridians of the places, called the *angles of pofition.*

Prob. I. Given the common latitude of two places on the fame parallel, and their difference of longitude, to find the diftance and angle of pofition (k).

Example. Required the diftance between St Mary's, in latitude 36° 57 N, longitude 25° 9′ W. and Cape Henry, in latitude 36° 57′ N, and longitude 76° 27′ W.

By Conftruction.

Defcribe the circle EPQS (fig. 60.) to reprefent the meridian of one of the places; draw the equator EQ and the earth's axis PS at right angles thereto; make ED, QA, each equal to the chord of 36° 57′, the

Plate CCCX[…]

(k) This problem may be expreffed thus:——Two places lying on the fame parallel, and of thefe four, the latitude, difference of longitude, diftance, and angle of pofition, any two being given to find the other two.——Now this problem contains four different cafes, the moft ufeful of which is given above. The others ferve rather as exercifes in fpherical trigonometry than of any real utility in navigation, and are therefore omitted. The fame is to be underftood of the following problems.

Great Circle Sailing.

the given latitude, and draw the parallel of latitude ABD, the radius of which is the tangent of 53° 3′, the co-latitude; describe the meridian PBS with the secant of 51° 18′, the difference of longitude; then A and B will be the two places. Draw the diameter AF, and through the points ABF describe a great circle; then the arch AB will be the distance, and the angle PAB the angle of position. Now these being measured by the rules given in *spherics*, will be found equal to 40° 28′ and 73° 54′ respectively.

By Calculation.

From P draw PG perpendicular to AB, by describing the arch with the secant of half the difference of longitude; then, in the right-angled spherical triangle AGP, are given AP = 53° 3′, the complement of latitude, and the angle APG = 25° 39′, half the difference of longitude; to find AG half the distance, and PAG the angle of position.

1. To find the distance.

As radius		10.00000
is to the sine of AP	53° 3′	9.90263
so is the sine of APG	25 39	9.63636
to the sine of AG	20 14	9.53899
	2	
Distance AB	40 28	

2. To find the angle of position.

As radius		10.00000
is to the cosine of AP	53° 3′	9.77896
so is the tangent of APG	25 39	9.68142
to the cotangent of PAG	73 54	9.46038

Prob. II. Given the latitude of a place, and the difference of longitude between it and a place on the equator, to find the distance between them, and the angles of position.

Example. Required the shortest distance between the island of St Thomas, in latitude 0° 0′, longitude 1° 0′ E, and Port St Julian, in latitude 48° 51′ S, and longitude 65° 10′ W?

By Construction.

Plate CCXLI.

Describe the circle EPQS (fig. 61.), to represent the meridian of one of the places; draw the equator EQ, and axis PS; make EB equal to the chord of 48° 51′, and B will represent Port St Julian; make CA equal to the semitangent of the complement of the difference of longitude; draw the diameter BF, and through the points BAF draw the great circle BAF; then AB will be the distance, ABE the angle of position at Port St Julian, and BAE the complement of that at St Thomas. These being measured by the rules given in spherics, will be found equal to 74° 35′, 71° 36′, and 51° 22′, respectively.

By Calculation

In the right-angled spherical triangle AEB, AE, and EB are given, to find AB and the angles A and B.

1. To find the distance.

As radius		10.00000
is to the cosine of AE	66° 10′	9.60646
so is the cosine of EB	48 51	9.81825
to the cosine of AB	74 35	9.42471

Now 74° 35′ = 4475 miles, which is 57 miles less than the distance found by Mercator's Sailing.

2. To find the angle of position at St Thomas.

As radius		10.00000
is to the sine of AE	66° 10′	9.96129
so is the cotangent of EB	48 51	9.94146
to the tang. ang. of position	38 38	9.90275

3. To find the angle of position at Port St Julian.

As radius		10.00000
is to the sine EB	48° 51′	9.87679
so is the cotangent of AE	66 10	9.64517
to the cotangent of ABE	71 36	9.52196

Hence a ship from St Thomas to Port St Julian must first steer S 38° 38′ W, and then by constantly altering her course towards the west, so as to arrive at Port St Julian on a course S 71° 36′ W, she will have sailed the shortest distance between those places.

Prob. III. Given the latitudes and longitudes of two places, to find the distance between them, and the angles of position.

Example. What is the shortest distance between the Lizard, in latitude 49° 57′ N, longitude 5° 15′ W, and Bermudas, in latitude 32° 35′ N, and longitude 63° 28′ W?

By Construction.

Describe the primitive circle (fig. 62.) to represent the meridian of one of the places; make EA = 32° 35′, and A will represent Bermudas; make E *a*, Q *b* each equal to 49° 57′; then with the tangent of the co-latitude 40° 3′ draw the parallel of latitude of the Lizard, and with the secant of 58° 13′, the given difference of longitude, draw the oblique circle PBS, intersecting the parallel of latitude in B; which will be the position of the Lizard. Draw the diameter AF, and through the points A, B, F, describe a circle; and the arch AB will be the distance, and the angles A and B the angles of position, which are measured as before.

By Calculation.

In the oblique-angled spherical triangle APB are AP, BP, the co-latitudes, and the angle APB the difference of longitude; to find the distance AB, and the angles of position PAB, PBA.

1. To find the distance.

Difference of long.	58° 13′	versed sine	9.67513
AP	57 25	sine	9.92563
BP	40 3	sine	9.80852
Difference	17 22	nat. v. sine 04559	
		25661	9.40928
Distance AB	45 45	nat. v. sine 30220*.	

2. To find the angle of position at the Lizard.

As the sine of AB	45° 45′	9.85510
is to the sine of AP	57 25	9.92563
so is the sine of P	58 13	9.92944
to the sine of B	89 20	9.99997

3. To find the angle of position at Bermudas.

As the sine of AB	45° 45′	9.85510
is to the sine of BP	40 3	9.80852
so is the sine of P	58 13	9.92944
to the sine of A	49 47	9.88286

The shortest distance between the Lizard and Bermudas is 45° 45′ or 2745 miles, which is 56 miles less than

* See *Mackay's Treatise on the Longitude*, where a complete Table of Nat. Versed Sines is given.

Great Circle Sailing.

than the diftance found by Mercator's failing. And a fhip to defcribe the fhorteft tract muft fail from the Lizard S. 89° 20′ W, and gradually leffen the courfe, fo as to arrive at Bermudas on the rhumb bearing S. 49° 47′ W. The direct courfe by Mercator's failing is S. 68° 10′ W.

From the preceding examples, it is evident that in order to fail on the arch of a great circle, the fhip muft continually alter her courfe. But as this is a difficulty too great to be admitted into the practice of navigation, it has been thought fufficiently exact to effect this by a kind of approximation; the principle of which is, that in fmall arches the difference between the arch and its chord or tangent is fo fmall, that the one may be fubftituted for the other in any nautical operations.

Upon this principle, the great circles on the earth are fuppofed to be made up of fhort right lines, each of which is a fegment of a rhumb line: and on this fuppofition the folution to the following problem is founded.

Prob. IV. Given the latitudes and longitudes of two places, to find the feveral points in a great circle paffing through them, which alter in longitude from either of the places by a given quantity; together with the courfes and diftances between thofe points.

Rule. Compute the diftance of the places, and their angles of pofition, by one of the preceding problems; find alfo the perpendicular from the pole to the great circle, paffing through the given places, and the feveral angles at the pole made by the given alterations of longitude between the perpendicular and the fucceffive meridians come to.

With this perpendicular, and the polar angles feverally, find as many correfponding latitudes by the following analogy:

As rad. : co-tan. perp. : : cof. 1ft pol. ang. : tang. 1ft lat.
: : cof. 2nd pol. ang. : tang. 2nd lat.
&c. &c.

Now having the latitudes of the feveral points in the great circle, and the difference of longitude between each, find the feveral courfes and diftances between them; and thefe will be the courfes and diftances the fhip muft run to keep nearly on the arch of a great circle.

Example I. A fhip from a place in latitude 37° 0′ N, longitude 23° 0′ W, bound to a place in the fame latitude, and in longitude 76° 27′ W, intends to fail as near the arch of a great circle as fhe can, by altering her courfe at every five degrees of longitude. Required the latitude of each point where the courfe is propofed to be altered, and alfo the courfes and diftances between thofe points?

Plate CCCXLI.

The triangle APB (fig. 63.) being defcribed, and the computation made as in Problem I. the diftance will be found equal to 42° 6′, and the angle of pofition A or B = 73° 9′.—Now the triangle APB being ifofceles, the perpendicular PI falls in the middle of AB; and the latitudes, courfes, and diftances being known in the half BI, thofe in the half IA will alfo be known.

Let the points a, b, c, d, &c. be the points arrived at on each alteration of five degrees of longitude; then will the arches Pa, Pb, Pc, Pd, &c. be the refpective co-latitudes of thofe places, and are the hypothenufes of the right-angled fpherical triangles PIa, PIb, PIc, PId, &c.

Now in the triangle PIB, given PB = 53° 0′, the angle PBI = 73° 9′, to find PI.

As radius		10.00000
is to the fine of PBI	73° 9′	9.98094
fo is the fine of PB	53 0	9.90235
to the fine of PI	49 51	9.88329

The angle IPB = $\left(\frac{53^\circ\ 27'}{2}\right)$ 26° 43′½, angle IPa = 21° 43′½, IPb = 16° 43′½, IPc = 11° 43′½, IPd = 6° 43′½, are the feveral polar angles.

To find the latitude of the point a.

As radius		10.00000
is to the cotangent of PI	49° 51′	9.92612
fo is the cofine firft polar angle	21 43½	9.96800
to the tangent of 1ft latitude	38 5	9.89412

By continuing the operation with the other polar angles, the fucceffive latitudes from a to I will be 38° 56′, 39° 33′, 39° 57′.

Now with the feveral latitudes, and refpective differences of longitude, compute the courfes and diftances. The refults are entered in the following Table; the calculations being performed on a piece of wafte paper.

Polar Angles.	Succeffive Long.	Diff. Long.	Succeffive Lat.	Diff. Lat.	Meridian Parts.	Merid. diff. lat.	Courfes.	Diftances.
IPB = 26° 43½′	23° 0′		37° 0′		2392.6			
IPa = 21 43½	28 0	300	38 5	65	2474.6	82.0	74° 43′	246.6
IPb = 16 43½	33 0	300	38 56	51	2539.8	65.2	77 44	240.2
IPc = 11 43½	38 0	300	39 33	37	2587.6	47.8	80 57	235.3
IPd = 6 43½	43 0	300	39 57	24	2618.8	31.2	84 4	231.9
	49 43½	403.5	40 9	12	2634.5	15.7	87 46	309.1
								1263.1

The courfes, and the firft diftance, are found by Mercator's Sailing; but as the other courfes are near the parallel, the diftances cannot be very exactly found by this method; another method is therefore ufed. The fum of the diftances is 1263.1, which doubled is 2526.2, agreeing with the diftance found as before. It may be obferved, that the diftance found by this method cannot be lefs than the laft diftance, or that given by Great Circle Sailing, as fome authors have found it.

Examxle II. A fhip from the Lizard, in latitude 49° 57′ N, longitude 5° 15′ W, bound to a place in latitude 32° 25′ N, and longitude 66° 39′ W, propofes to fail on a great circle, and to alter her courfe at every

every five degrees of longitude. Required the latitudes of the places where the ſhip is to alter her courſe, and alſo the courſe and diſtance between each?

Having deſcribed the triangle (fig. 64.) and performed the computation as in Problem III. the diſtance AB is found =47° 54′, the angle of poſition PBA at the Lizard 87° 15′, and that at the place bound to 49° 35′.

Draw PI at right angles to AB, and in the equator lay off from the centre the tangents of 5, 10, 15, 20, &c. to 55 degrees, and theſe will be the centres of the arches of co-latitude to every 5° of difference of longitude.

To find the perpendicular PI.

As radius		10.00000
is to the ſine of PAB	49° 35′	9.88158
ſo is the ſine of PA	57 35	9.92643
to the ſine of PI	40 0	9.80801

To find the polar angle API.

As radius		10.00000
is to the coſine of AP	57° 35′	9.72922
ſo is the tangent of PAB	49 35	10.06978
to the co-tangent of API	57 49	9.79900

Now the polar angle API, or the difference of longitude between the perpendicular and the meridian of the place bound to, 57° 49′, being taken from 61° 24′, the whole difference of longitude, leaves 3° 35′ for the difference of longitude between the Lizard and the perpendicular; alſo 5°, the propoſed alteration of longitude, being ſubtracted as often as it can be from 57° 49′, leaves the ſeveral polar angles; with which and the perpendicular PI the ſeveral latitudes arrived at are found as in the preceding example: then with theſe latitudes and the differences of longitude between them, find the ſucceſſive courſes and diſtances. The ſeveral reſults are placed in the following Table; the calculations being performed on a piece of waſte paper.

Polar Angles.	Succeſſive Longs.	Diff. Long.	Succeſſive Lats.	Diff. Lat.	Meridian Parts.	Merid. diff. lat.	Courſes.	Diſtances.
	5° 14′		49° 57′		3469.8			
IPB = 3° 35′	8 49	215	50 0	3	3474.5	4.7	88° 45′	138.3
IP*a* = 2 49	11 38	169	49 58	2	3471.4	3.1	88 57	108.7
IP*b* = 7 49	16 38	300	49 45	13	3451.2	20.2	86 9	193.8
IP*c* = 12 49	21 38	300	49 18	27	3409.6	41.6	82 6	196.6
IP*d* = 17 49	26 38	300	48 37	41	3347.2	62.4	78 15	201.4
IP*e* = 22 49	31 38	300	47 42	55	3264.7	82.5	74 37	207.3
IP*f* = 27 49	36 38	300	46 31	71	3160.4	104.3	70 50	216.3
IP*g* = 32 49	41 38	300	45 3	88	3034.2	126.2	67 10	226.8
IP*h* = 37 49	46 38	300	43 17	106	2886.4	147.8	63 46	239.8
IP*i* = 42 49	51 38	300	41 10	127	2714.9	171.5	60 15	255.9
IP*k* = 47 49	56 38	300	38 41	149	2520.5	194.4	57 3	273.9
IP*l* = 52 49	61 38	300	35 46	175	2300.7	219.8	53 46	296.1
	66 38	300	32 25	201	2058.0	242.7	51 2	319.6
								2874.5

As the four firſt courſes are near the parallel, the correſponding diſtances were not found by Mercator's Sailing. The ſum of the diſtances 2874.5 agrees very well with, and is not leſs than, 47° 54′, or 2874 miles, the ſhorteſt diſtance between the places.

Chap. XIII. *Of Sea-Charts.*

The charts uſually employed in the practice of navigation are of two kinds, namely, *Plane* and *Mercator's Charts*. The firſt of theſe is adapted to repreſent a portion of the earth's ſurface near the equator; and the laſt for all portions of the earth's ſurface. For a particular deſcription of theſe, reference has already been made from the article Chart, to thoſe of Plane and Mercator: and as theſe charts are particularly deſcribed under the above articles, it is therefore ſufficient in this place to deſcribe their uſe.

Uſe of the Plane Chart.

Prob. I. To find the latitude of a place on the chart.

Rule. Take the leaſt diſtance between the given place and the neareſt parallel of latitude; now this diſtance applied the ſame way on the graduated meridian, from the extremity of the parallel, will give the latitude of the propoſed place.

Thus the diſtance between Bonaviſta and the parallel of 15 degrees, being laid from that parallel upon the graduated meridian, will reach to 16° 5′, the latitude required.

Prob. II. To find the courſe and diſtance between two given places on the chart.

Rule. Lay a ruler over the given places, and take the neareſt diſtance between the centre of any of the compaſſes on the chart and the edge of the ruler; move this extent along, ſo as one point of the compaſs may touch the edge of the rule, and the ſtraight line joining their points may be perpendicular thereto; then will the other point ſhow the courſe: The interval between the places, being applied to the ſcale, will give the required diſtance.

Thus the courſe from Palma to St Vincent will be found to be about SSW ¾ W. and the diſtance 13°¼ or 795 m.

Prob. III. The courſe and diſtance ſailed from a known place being given, to find the ſhip's place on the chart.

Rule. Lay a ruler over the place ſailed from, parallel

Sea-Charts. rallel to the rhumb, expreffing the given courfe; take the diftance from the fcale, and lay it off from the given place by the edge of the ruler; and it will give the point reprefenting the fhip's prefent place.

Thus, fuppofe a fhip had failed SW*b*W 160 miles from Cape Palmas; then by proceeding as above, it will be found that fhe is in latitude 2° 57′ N.

The various other problems that may be refolved by means of this chart require no further explanation, being only the conftruction of the remaining problems in Plane Sailing on the chart.

Ufe of Mercator's Chart.

The method of finding the latitude and longitude of a place, and the courfe or bearing between two given places by this chart, is performed exactly in the manner as in the Plane Chart, which fee.

Prob. I. To find the diftance between two given places on the chart.

Case I. When the given places are under the fame meridian.

Rule. The difference or fum of their latitudes, according as they are on the fame or on oppofite fides of the equator, will be the diftance required.

Case II. When the given places are under the fame parallel.

Rule. If that parallel be the equator, the difference or fum of their longitudes is the diftance; otherwife, take half the interval between the places, lay it off upwards and downwards on the meridian from the given parallel, and the intercepted degrees will be the diftance between the places.

Or, take an equal extent of a few degrees from the meridian on each fide of the parallel, and the number of extents, and parts of an extent, contained between the places, being multiplied by the length of an extent, will give the required diftance.

Case III. When the given places differ both in latitude and longitude.

Rule. Find the difference of latitude between the given places, and take it from the equator or graduated parallel; then lay a ruler over the two places, and move one point of the compafs along the edge of the ruler until the other point juft touches a parallel; then the diftance between the place where the point of the compafs refted by the edge of the ruler, and the point of interfection of the ruler and parallel, being applied to the equator, will give the diftance between the places in degrees and parts of a degree, which multiplied by 60 will reduce it to miles.

Prob. II. Given the latitude and longitude in, to find the fhip's place on the chart.

Rule. Lay a ruler over the given latitude, and lay off the given longitude from the firft meridian by the edge of the ruler, and the fhip's prefent place will be obtained.

Prob. III. Given the courfe failed from a known place, and the latitude in, to find the fhip's prefent place on the chart.

Rule. Lay a ruler over the place failed from, in the direction of the given courfe, and its interfection with the parallel of latitude arrived at will be the fhip's prefent place.

Prob. IV. Given the latitude of the place left and the courfe and diftance failed, to find the fhip's prefent place on the chart.

Rule. The ruler being laid over the place failed from and in the direction of the given courfe, take the diftance failed from the equator; put one point of the compafs at the interfection of any parallel with the ruler, and the other point of the compafs will reach to a certain place by the edge of the ruler. Now this point remaining in the fame pofition, draw in the other point of the compafs until it juft touch the above parallel when fweeped round: apply this extent to the equator, and it will give the difference of latitude. Hence the latitude in will be known, and the interfection of the correfponding parallel with the edge of the ruler will be the fhip's prefent place.

Method of finding the Latitude and Longitude at fea.

The other problems of Mercator's Sailing may be very eafily refolved by this chart; but as they are of lefs ufe than thofe given, they are therefore omitted, and may ferve as an exercife to the ftudent.

BOOK II.

Containing the method of finding the Latitude and Longitude of a Ship at Sea, and the Variation of the Compafs.

Chap. I. *Of Hadley's Quadrant.*

Hadley's quadrant is the chief inftrument in ufe at prefent for obferving altitudes at fea. The form of this inftrument, according to the prefent mode of conftruction, is an octagonal fector of a circle, and therefore contains 45 degrees; but becaufe of the double reflection, the limb is divided into 90 degrees. See Astronomy and Quadrant. Fig. 65 reprefents a quadrant of the common conftruction, of which the following are the principal parts. Plate CCCXL.

1. ABC, the frame of the quadrant.
2. BC, the arch or limb.
3. D, the index; *a b*, the fubdividing fcale.
4. E, the index-glafs.
5. F, the fore horizon-glafs.
6. G, the back horizon-glafs.
7. K, the coloured or dark glaffes.
8. HI, the vanes or fights.

Of the Frame of the Quadrant.

The frame of the quadrant confifts of an arch BC, firmly attached to the two radii AB, AC, which are bound together by the braces L M, in order to ftrengthen it, and prevent it from warping.

Of the Index D.

The index is a flat bar of brafs, and turns on the centre of the octant: at the lower end of the index there is an oblong opening; to one fide of this opening the vernier fcale is fixed, to fubdivide the divifions of the arch; at the end of the index there is a piece of brafs, which bends under the arch, carrying a fpring to make the fubdividing fcale lie clofe to the divifions. It is alfo furnifhed with a fcrew to fix the index in any defired pofition. The beft inftruments have an adjufting fcrew fitted to the index, that it may be moved more flowly, and with greater regularity and accuracy, than by the hand. It is proper, however, to obferve, that the index muft be previoufly fixed near its right pofition by the above-mentioned fcrew.

Of

Method of finding the Latitude and Longitude at Sea.

Of the Index Glaſs E.

Upon the index, and near its axis of motion, is fixed a plane ſpeculum, or mirror of glaſs quickſilvered. It is ſet in a braſs frame, and is placed ſo that its face is perpendicular to the plane of the inſtrument. This mirror being fixed to the index moves along with it, and has its direction changed by the motion thereof; and the intention of this glaſs is to receive the image of the ſun, or any other object, and reflect it upon either of the two horizon-glaſſes, according to the nature of the obſervation.

The braſs frame with the glaſs is fixed to the index by the ſcrew *c*; the other ſcrew ſerves to re-place it in a perpendicular poſition, if by any accident it has been deranged.

Of the Horizon Glaſſes F, G.

On the radius AB of the octant are two ſmall ſpeculums: the ſurface of the upper one is parallel to the index glaſs, and that of the lower one perpendicular thereto, when *o* on the index coincides with *o* on the limb. Theſe mirrors receive the reflected rays, and tranſmit them to the obſerver.

The horizon-glaſſes are not entirely quickſilvered; the upper one F is only ſilvered on its lower half, or that next the plane of the quadrant, the other half being left tranſparent, and the back part of the frame cut away, that nothing may impede the ſight through the unſilvered part of the glaſs. The edge of the foil of this glaſs is nearly parallel to the plane of the inſtrument, and ought to be very ſharp, and without a flaw. The other horizon-glaſs is ſilvered at both ends. In the middle there is a tranſparent ſlit, through which the horizon may be ſeen.

Each of theſe glaſſes is ſet in a braſs frame, to which there is an axis paſſing through the wood work, and is fitted to a lever on the under ſide of the quadrant, by which the glaſs may be turned a few degrees on its axis, in order to ſet it parallel to the index-glaſs. The lever has a contrivance to turn it ſlowly, and a button to fix it. To ſet the glaſſes perpendicular to the plane of the inſtrument, there are two ſunk ſcrews, one before and one behind each glaſs: theſe ſcrews paſs through the plate on which the frame is fixed into another plate; ſo that by looſening one and tightening the other of theſe ſcrews, the direction of the frame with its mirror may be altered, and ſet perpendicular to the plane of the inſtrument.

Of the Coloured Glaſſes K.

There are uſually three coloured glaſſes, two of which are tinged red and the other green. They are uſed to prevent the ſolar rays from hurting the eye at the time of obſervation. Theſe glaſſes are ſet in a frame, which turns on a centre, ſo that they may be uſed ſeparately or together as the brightneſs of the ſun may require. The green glaſs is particularly uſeful in obſervations of the moon; it may be alſo uſed in obſervations of the ſun, if that object be very faint. In the fore-obſervation, theſe glaſſes are fixed as in fig. 65. but when the back-obſervation is uſed, they are removed to N.

Plate CCCXLI.

Of the two Sight Vanes H, I.

Each of theſe vanes is a perforated piece of braſs, deſigned to direct the ſight parallel to the plane of the quadrant. That which is fixed at I is uſed for the fore, and the other for the back, obſervation. The vane I has two holes, one exactly at the height of the ſilvered part of the horizon-glaſs, the other a little higher, to direct the ſight to the middle of the tranſparent part of the mirror.

Of the Diviſions on the Limb of the Quadrant.

The limb of the quadrant is divided from right to left into 90 primary diviſions, which are to be conſidered as degrees, and each degree is ſubdivided into three equal parts, which are therefore of 20 minutes each: the intermediate minutes are obtained by means of the ſcale of diviſions at the end of the index.

Of the Vernier or ſubdividing Scale.

The dividing ſcale contains a ſpace equal to 21 diviſions of the limb, and is divided into 20 equal parts. Hence the difference between a diviſion on the dividing ſcale and a diviſion on the limb is one-twentieth of a diviſion on the limb, or one minute. The degree and minute pointed out by the dividing ſcale may be eaſily found thus.

Obſerve what minute on the dividing ſcale coincides with a diviſion on the limb; this diviſion being added to the degree and part of a degree on the limb, immediately preceding the firſt diviſion on the dividing ſcale, will be the degree and minute required.

Thus ſuppoſe the fourteenth minute on the dividing ſcale coincided with a diviſion on the limb, and that the preceding diviſion on the limb to *o* on the vernier was $56^\circ\ 40'$; hence the diviſion ſhown by the vernier is $56^\circ\ 54'$. A magnifying glaſs will aſſiſt the obſerver to read off the coinciding diviſions with more accuracy.

Adjuſtments of Hadley's Quadrant.

The adjuſtments of the quadrant conſiſt in placing the mirrors perpendicular to the plane of the inſtrument. The fore horizon-glaſs muſt be ſet parallel to the ſpeculum, and the planes of the ſpeculum and back horizon glaſs produced muſt be perpendicular to each other when the index is at *o*.

Adjustment I. To ſet the index-glaſs perpendicular to the plane of the quadrant.

Method I. Set the index towards the middle of the limb, and hold the quadrant ſo that its plane may be nearly parallel to the horizon: then look into the index-glaſs; and if the portion of the limb ſeen by reflection appears in the ſame plane with that ſeen directly, the ſpeculum is perpendicular to the plane of the inſtrument. If they do not appear in the ſame plane, the error is to be rectified by altering the poſition of the ſcrews behind the frame of the glaſs.

Method II. This is performed by means of the two adjuſting tools fig. 66, 67, which are two wooden frames, having two lines on each, exactly at the ſame diſtance from the bottom.

Place the quadrant in an horizontal poſition on a table; put the index about the middle of the arch; turn back the dark glaſſes; place one of the abovementioned tools near one end of the arch, and the other at the oppoſite end, the ſide with the lines being towards the index-glaſs; then look into the index-glaſs, directing the ſight parallel to the plane of the inſtrument, and one of the tools will be ſeen by direct viſion, and the other by reflection. By moving the index a little, they may be brought exactly together.

ther. If the lines coincide, the poſition of the mirror is right; if not, they muſt be made to coincide by altering the ſcrews behind the frame, as before.

Adjustment II. To ſet the fore horizon-glaſs perpendicular to the plane of the inſtrument.

Set the index to *o*; hold the plane of the quadrant parallel to the horizon; direct the ſight to the horizon, and if the horizons ſeen directly and by reflection are apparently in the ſame ſtraight line, the fore horizon-glaſs is perpendicular to the plane of the inſtrument; if not, one of the horizons will appear higher than the other. Now if the horizon ſeen by reflection is higher than that ſeen directly, releaſe the neareſt ſcrew in the pedeſtal of the glaſs, and ſcrew up that on the farther ſide, till the direct and reflected horizons appear to make one continued ſtraight line. But if the reflected horizon is lower than that ſeen directly, unſcrew the fartheſt, and ſcrew up the neareſt ſcrew till the coincidence of the horizons is perfect, obſerving to leave both ſcrews equally tight, and the fore horizon-glaſs will be perpendicular to the plane of the quadrant.

Adjustment III. To ſet the fore horizon-glaſs parallel to the index-glaſs, the index being at *o*.

Set *o* on the index exactly to *o* on the limb, and fix it in that poſition by the ſcrew at the under ſide; hold the plane of the quadrant in a vertical poſition, and direct the ſight to a well-defined part of the horizon; then if the horizon ſeen in the ſilvered part coincides with that ſeen through the tranſparent part, the horizon-glaſs is adjuſted; but if the horizons do not coincide, unſcrew the milled ſcrew in the middle of the lever on the other ſide of the quadrant, and turn the nut at the end of the lever until both horizons coincide, and fix the lever in this poſition by tightening the milled ſcrew.

As the poſition of the glaſs is liable to be altered by fixing the lever, it will therefore be neceſſary to re-examine it, and if the horizons do not coincide, it will be neceſſary either to repeat the adjuſtment, or rather to find the error of adjuſtment, or, as it is uſually called, the *index-error;* which may be done thus:

Direct the ſight to the horizon, and move the index until the reflected horizon coincides with that ſeen directly; then the difference between *o* on the limb and *o* on the vernier is the index error; which is additive when the beginning of the vernier is to the right of *o* on the limb, otherwiſe ſubtractive.

Adjustment IV. To ſet the back horizon-glaſs perpendicular to the plane of the inſtrument.

Put the index to *o*; hold the plane of the quadrant parallel to the horizon, and direct the ſight to the horizon through the back ſight vane. Now if the reflected horizon is in the ſame ſtraight line with that ſeen through the tranſparent part, the glaſs is perpendicular to the plane of the inſtrument: If the horizons do not unite, turn the ſunk ſcrews in the pedeſtal of the glaſs until they are apparently in the ſame ſtraight line.

Adjustment V. To ſet the back horizon-glaſs perpendicular to the plane of the index-glaſs produced, the index being at *o*.

Let the index be put as much to the right of *o* as twice the dip of the horizon amounts to; hold the quadrant in a vertical poſition, and apply the eye to the back vane: then if the reflected horizon coincides with that ſeen directly, the glaſs is adjuſted; if they do not coincide, the ſcrew in the middle of the lever on the other ſide of the quadrant muſt be releaſed, and the nut at its extremity turned till both horizons coincide. It may be obſerved, that the reflected horizon will be inverted; that is, the ſea will be apparently uppermoſt and the ſky lowermoſt.

As this method of adjuſtment is eſteemed troubleſome, and is often found to be very difficult to perform at ſea, various contrivances have therefore been propoſed to render this adjuſtment more ſimple. Some of theſe are the following.

1. Mr Dollond's method of adjuſting the back horizon-glaſs.

In this method an index is applied to the back horizon-glaſs, by which it may be moved ſo as to be parallel to the index-glaſs, when *o* on the vernier coincides with *o* on the limb. When this is effected, the index of the back horizon-glaſs is to be moved exactly 90° from its former poſition, which is known by means of a divided arch for that purpoſe; and then the plane of the back horizon-glaſs will be perpendicular to the plane of the index-glaſs produced.

2. Mr Blair's method of adjuſting the back horizon-glaſs.

All that is required in this method is to poliſh the lower edge of the index-glaſs, and expoſe it to view. The back horizon-glaſs is adjuſted by means of a reflection from this poliſhed edge, in the very ſame method as the fore horizon-glaſs is adjuſted by the common method.

In order to illuſtrate this, let R I H E (fig. 68.) repreſent a pencil of rays emitted from the object R, incident on the index-glaſs I, from which it is reflected to the fore horizon-glaſs H, and thence to the eye at E. By this double reflection, an image of the object is formed at *r*. RHE repreſents another pencil from the ſame object R, coming directly through the fore horizon-glaſs to the eye at E; ſo that the doubly reflected image *r* appears coincident with the object R itſelf, ſeen directly. Plate CCCXLII.

When this coincidence is perfect, and the object R ſo very diſtant as to make the angle IRH inſenſible, the poſition of the ſpeculums I and H will differ inſenſibly from paralleliſm; that is, the quadrant will be adjuſted for the fore-obſervation. Now it is from the eaſe and accuracy with which this adjuſtment can at any time be made, that the fore-obſervation derives its ſuperiority over the back-obſervation. But by grinding the edge of the index glaſs perpendicular to its reflecting ſurface, and poliſhing it, the back-obſervation is rendered capable of an adjuſtment equally eaſy and accurate as the fore horizon-glaſs: for by a pencil of rays emitted from the object S, incident on the reflecting edge of the index-glaſs D, thence reflected to the back horizon-glaſs B, and from that to the eye at *e*, an image will be formed at *s*; which image being made to coincide with the object S itſelf, ſeen directly, aſcertains the poſition of the back horizon glaſs relative to the index-glaſs with the ſame preciſion, and in a manner equally direct, as the former operation does that of the fore horizon-glaſs.

Directions for adjuſting the Back Horizon-Glaſs.

The method of adjuſting the quadrant for the back-obſervation

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observation is this. If it is to be done without making use of the telescope, place the index at *o*, and, applying the eye to the hole in the sight vane (K), or tube for directing the sight, direct it through the back horizon-glass to the horizon, if that is the object to be used for adjusting. The two horizons are then to be made to coincide, holding the quadrant first in a vertical and then in an horizontal position; by which means both adjustments will be effected as in the fore-observation.

There will be no difficulty in finding the reflected horizon, if the observer first directs his eye to that part of the horizon-glass where he observes the image of the polished edge of the index-glass, which will appear double. When the direct horizon is made to appear in this space, the reflected one will be seen close by it, unless the instrument wants a great adjustment. In this case, a little motion of the back horizon-glass backwards and forwards will presently bring it in view.

When the horizon, or any obscure terrestrial object, is to be made use of for adjusting by means of the reflecting edge, there is a precaution to be taken, without which the observer will sometimes meet with what will appear an unaccountable difficulty; for if the sky, or other object behind him, should happen to be pretty bright, he will not be able to discern the horizon at all. This arises from the image of the object behind him, which is reflected from the silvered surface of the index-glass, appearing to coincide with the horizon; in which case, the bright picture of the former, which is formed in the bottom of the eye, prevents the fainter impression of the latter from being perceived. This will be avoided, either by applying a black sceeen over the silvered surface of the index-glass, or, without being at this trouble, by standing at a door or window, so that only the dark objects within can be reflected from the index-glass: but if the observation is to be made in the open air, a hat, or any such dark obstacle, held before the silvered surface of the index-glass, will very effectually remove this inconvenience.

It may be remarked, that some observers, instead of making the principal adjustment, place the speculums parallel, by moving the index without altering the position of the horizon-glass: and the difference between *o* on the vernier and *o* on the limb is the index error, which must be subtracted from all angles measured by the back-observation, when *o* on the index is to the right of *o* on the limb; and added when to the left.

3. Mr Wright's method of adjusting the back horizon-glass of his improved patent quadrant.

Plate CCXLII.

Fig. 69. is a representation of the quadrant complete in all its parts for use. A, is the reflecting surface of the index-glass, which is made of the usual length, and $\frac{8}{10}$ of an inch broad. The bottom part is covered in front by the brass frame, and the reflecting surface is $\frac{7}{10}$ on the back. B, the fore horizon-glass, placed as usual: O, the back horizon-glass, now placed under the fore-sight vane on the first radius of the quadrant I: C, the sight-vane of the fore horizon-glass: D, the sight-vane of the back horizon-glass: E, the coloured glasses in a brass frame, in the proper place for the fore-observation: F, a hole in the frame to receive the coloured glasses when an observation is to be taken with the back horizon-glass in the common way, by turning the back to the sun: G, a hole in the frame of the farthest radius K, to receive the coloured glasses when an observation is to be taken by the new method; which is by looking through the lower hole in the sight-vane of the back horizon-glass, directly at the sun in the line of sight DN; the horizon from behind will then be reflected from the back of the index-glass to the horizon-glass, and from thence to the eye. (See fig. 73.) H, a brass clamp on the upper end of the index, having a milled screw underneath, which fastens the round plate to the index when required. (See fig. 70.) IK, the graduated arch of the quadrant divided into 90 degrees: L, the brass index which moves over the graduated arch: M, the vernier to subdivide the divisions on the arch into single minutes of a degree.

Fig. 70. shows the upper part of the index L on a larger scale, with part of the brass frame that fastens the index-glass, and the three adjusting screws D to adjust its axis vertical to the plane of the quadrant: B, the centre on which the milled plate O moves over the index: The dotted line BF is the distance it is required to move: K, the adjusting screw to stop it in its proper place for adjusting the back observation-glass: G, a piece of brass fastened to the index opposite to the clamp H, to keep the plate O always close to the index L.

Fig. 71. represents the parallel position of the index and horizon-glasses after adjustment by the sun: BC, a ray from the sun incident on the index-glass C, and from thence reflected to the fore horizon-glass D, and again to the eye at E, in the line DE, where the eye sees the sun at A by direct vision, and the image by reflection in one; the parallel lines AE and BC being so near to each other, that no apparent angle can be observed in the planes of the index and horizon-glass, when adjusted by a distant object.

In fig. 72. the index-glass is removed 45 degrees from the plane of the fore horizon-glass, and fixed in its proper place for adjusting the back horizon-glass parallel to its plane, in the same manner as the fore horizon-glass is adjusted.

In fig. 73. the index-glass (after the adjustment of the fore and back horizon-glasses) is carried forward by the index on the arch 90 degrees, and makes an angle of 45° with the plane of the fore horizon-glass, and is at right angles to the plane of the back horizon-glass. The eye at E now sees the sun in the horizon at H, reflected by the index and horizon-glasses from the zenith at Z, the image and object being 90 degrees

(K) Besides the hole in the sight vane commonly made, there must be another nearer to the horizon-glass, and so placed that an eye directed through it to the centre of the horizon-glass shall there perceive the image of the polished edge of the index-glass. This hole must not be made small like the other, but equal to the ordinary size of the pupil of the eye, there being on some occasions no light to spare.

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degrees diftant. The back horizon K is now reflected from the back furface of the index-glafs C to the horizon-glafs M, and from thence to the eye at D, in a right line with the fore horizon F. In order to make an exact contact of the fore and back horizons at F, the index muft be advanced beyond the 90th degree on the arch, by a quantity equal to twice the dip of the horizon.

The quadrant is adjufted for the fore-obfervation as ufual, having previoufly fixed the index-glafs in its proper place by the milled fcrew at H, as reprefented in fig. 70.

To adjuft the Quadrant for the Back-obfervation.

Plate CCCXLII.

Faften the index to 90° on the limb; loofen the fcrew H (fig. 70.), and turn the plate O by the milled edge until the end of the adjufting fcrew K touch the edge of the clamp M; and by means of a diftant object obferve if the glaffes are then parallel, as at fig. 71.: if they are, faften the fcrew H; if not, with a fcrew-driver turn the fcrew K gently to the right or left to make them perfect, and then faften the fcrew. Now remove the index back to O on the limb, and the index-glafs will be parallel to the back horizon-glafs E, fig. 72.: If not, make them fo by turning the adjufting fcrew of the glafs E, the eye being at the upper hole in the fight-vane D, and the fight directed to the horizon, or any diftant object in the direction DN (fig. 69.) Now the index remaining in this pofition, the index-glafs is to be returned, to ftop at the pin E, and it will be parallel to the fore horizon-glafs as at firft: then the quadrant will be adjufted for both methods of obfervation.

To obferve the Sun's Altitude by the Back-obfervation.

Remove the coloured glaffes to G (fig. 69.), and look through the lower hole in the fight-vane D, in the line of direction DN, directly to the fun, and move the index forward on the arch exactly in the fame manner as in the fore-obfervation: make the contact of the fun's limb and the back horizon exact, and the degrees and minutes fhown by the index on the limb is the fun's zenith diftance. It may be obferved, that the horizon will be inverted. If the fun's lower limb be obferved, the femidiameter is to be fubtracted from the zenith diftance; but if the upper limb is obferved, the femidiameter is to be added.

The obfervation may be made in the ufual manner, by turning the back to the fun. In this cafe the coloured glaffes are to be fhifted to F, and proceed according to the directions formerly given.

Ufe of Hadley's Quadrant.

The altitude of any object is determined by the pofition of the index on the limb, when by reflection that object appears to be in contact with the horizon.

If the object whofe altitude is to be obferved be the fun, and if fo bright that its image may be feen in the tranfparent part of the fore horizon-glafs, the eye is to be applied to the upper hole in the fight-vane; otherwife, to the lower hole: and in this cafe, the quadrant is to be held fo that the fun may be bifected by the line of feparation of the filvered and tranfparent parts of the glafs. The moon is to be kept as nearly as poffible in the fame pofition; and the image of the ftar is to be obferved in the filvered part of the glafs adjacent to the line of feparation of the two parts.

There are two different methods of taking obfervations with the quadrant. In the firft of thefe the face of the obferver is directed towards that part of the horizon immediately under the fun, and is therefore called the *fore obfervation*. In the other method, the obferver's back is to the fun, and it is hence called the *back-obfervation*. This laft method of obfervation is to be ufed only when the horizon under the fun is obfcured, or rendered indiftinct by fog or any other impediment.

In taking the fun's altitude, whether by the fore or back obfervation, the obferver muft turn the quadrant about upon the axis of vifion, and at the fame time turn himfelf about upon his heel, fo as to keep the fun always in that part of the horizon-glafs which is at the fame diftance as the eye from the plane of the quadrant. In this way the reflected fun will defcribe an arch of a parallel circle round the true fun, whofe convex fide will be downwards in the fore-obfervation and upwards in the back; and confequently, when by moving the index, the loweft point of the arch in the fore-obfervation, or higheft in the back, is made to touch the horizon, the quadrant will ftand in a vertical plane, and the altitude above the vifible horizon will be properly obferved. The reafon of thefe operations may be thus explained: The image of the fun being always kept in the axis of vifion, the index will always fhow on the quadrant the diftance between the fun and any object feen directly which its image appears to touch; therefore, as long as the index remains unmoved, the image of the fun will defcribe an arch everywhere equidiftant from the fun in the heavens, and confequently a parallel circle about the fun, as a pole. Such a tranflation of the fun's image can only be produced by the quadrant's being turned about upon a line drawn from the eye to the fun, as an axis. A motion of rotation upon this line may be refolved into two, one upon the axis of vifion, and the other upon a line on the quadrant perpendicular to the axis of vifion; and confequently a proper combination of thefe two motions will keep the image of the fun conftantly in the axis of vifion, and caufe both jointly to run over a parallel circle about the fun in the heavens: but when the quadrant is vertical, a line thereon perpendicular to the axis of vifion becomes a vertical axis; and as a fmall motion of the quadrant is all that is wanted, it will never differ much in practice from a vertical axis. The obferver is directed to perform two motions rather than the fingle one equivalent to them on a line drawn from the eye to the fun; becaufe we are not capable, while looking towards the horizon, of judging how to turn the quadrant about upon the elevated line going to the fun as an axis, by any other means than by combining the two motions above mentioned, fo as to keep the fun's image always in the proper part of the horizon-glafs. When the fun is near the horizon, the line going from the eye to the fun will not be far removed from the axis of vifion; and confequently the principal motion of the quadrant will be performed on the axis of vifion, and the part of motion made on the vertical axis will be but fmall. On the contrary, when the fun is near the zenith, the line going to the fun is not far removed from a vertical line, and confequently

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quently the principal motion of the quadrant will be performed on a vertical axis, by the obferver's turning himfelf about, and the part of the motion made on the axis of vifion will be but fmall. In intermediate altitudes of the fun, the motions of the quadrant on the axis of vifion, and on the vertical axis, will be more equally divided.

Obfervations taken with the quadrant are liable to errors, arifing from the bending and elafticity of the index, and the refiftance it meets with in turning round its centre: whence the extremity of the index, on being pufhed along the arch, will fenfibly advance before the index-glafs begins to move, and may be feen to recoil when the force acting on it is removed. Mr Hadley feems to have been apprehenfive that his inftrument would be liable to errors from this caufe; and in order to avoid them, gives particular directions that the index be made broad at the end next the centre, and that the centre, or axis itfelf, have as eafy a motion as is confiftent with fteadinefs; that is, an entire freedom from loofenefs, or *fhake* as the workmen term it. By ftrictly complying with thefe directions the error queftion may indeed be greatly diminifhed; fo far, perhaps, as to render it nearly infenfible, where the index is made ftrong, and the proper medium between the two extremes of a fhake at the centre on one hand, and too much ftiffnefs there on the other, is nicely hit; but it cannot be entirely corrected. For to more or lefs of bending the index will always be fubject; and fome degree of refiftance will remain at the centre, unlefs the friction there could be totally removed, which is impoffible.

Of the reality of the error to which he is liable from this caufe, the obferver, if he is provided with a quadrant furnifhed with a fcrew for moving the index gradually, may thus fatisfy himfelf. After finifhing the obfervation, lay the quadrant on a table, and note the angle; then cautioufly loofen the fcrew which faftens the index, and it will immediately, if the quadrant is not remarkably well conftructed, be feen to ftart from its former fituation, more or lefs according to the perfection of the joint and the ftrength of the index. This ftarting, which is owing to the index recoiling after being releafed from the confined ftate it was in during the obfervation. will fometimes amount to feveral minutes; and its direction will be oppofite to that in which the index was moved by the fcrew at the time of finifhing the obfervation. But how far it affects the truth of the obfervation, depends on the manner in which the index was moved in fetting it to *o*, for adjufting the inftrument; or in finifhing the obfervations neceffary for finding the index error.

The eafieft and beft rule to avoid thefe errors feems to be this: In all obfervations made by Hadley's quadrant, let the obferver take notice conftantly to finifh his obfervations, by moving the index in the fame direction which was ufed in fetting it to *o* for adjufting; or in the obfervations neceffary for finding the index error. If this rule is obferved, the error arifing from the fpring of the index will be obviated. For as the index was bent the fame way, and in the fame degree in adjufting as in obferving, the truth of the obfervations will not be affected by this bending.

To take Altitudes by the Fore-obfervation.

I. *Of the Sun.*

Turn down either of the coloured glaffes before the horizon-glafs, according to the brightnefs of the fun; direct the fight to that part of the horizon which is under the fun, and move the index until the coloured image of the fun appears in the horizon-glafs; then give the quadrant a flow vibratory motion about the axis of vifion; move the index until the lower or upper limb of the fun is in contact with the horizon, at the loweft part of the arch defcribed by this motion; and the degrees and minutes fhown by the index on the limb will be the altitude of the fun.

II. *Of the Moon.*

Put the index to *o*, turn down the green glafs, place the eye at the lower hole in the fight-vane, and obferve the moon in the filvered part of the horizon-glafs; move the index gradually, and follow the moon's reflected image until the enlightened limb is in contact with the horizon, at the lower part of the arch defcribed by the vibratory motion as before, and the index will fhow the altitude of the obferved limb of the moon. If the obfervation is made in the daytime, the coloured glafs is unneceffary.

III. *Of a Star or Planet.*

The index being put to *o*, direct the fight to the ftar through the lower hole in the fight-vane and tranfparent part of the horizon-glafs; move the plane of the quadrant a very little to the left, and the image of the ftar will be feen in the filvered part of the glafs. Now move the index, and the image of the ftar will appear to defcend; continue moving the index gradually until the ftar is in contact with the horizon at the loweft part of the arch defcribed; and the degrees and minutes fhown by the index on the limb will be the altitude of the ftar.

To take Altitudes by the Back-obfervation.

I. *Of the Sun.*

Put the ftem of the coloured glaffes into the perforation between the horizon-glaffes, turn down either according to the brightnefs of the fun, and hold the quadrant vertically; then direct the fight through the hole in the back fight-vane, and the tranfparent flit in the horizon-glafs to that part of the horizon which is oppofite to the fun; now move the index till the fun is in the filvered part of the glafs, and by giving the quadrant a vibratory motion, the axis of which is that of vifion, the image of the fun will defcribe an arch whofe convex fide is upwards; bring the limb of the fun, when in the upper part of this arch, in contact with the horizon; and the index will fhow the altitude of the other limb of the fun.

II. *Of the Moon.*

The altitude of the moon is obferved in the fame manner as that of the fun, with this difference only, that the ufe of the coloured glafs is unneceffary unlefs the moon is very bright; and that the enlightened limb, whether

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whether it be the upper or lower, is to be brought in contact with the horizon.

III. *Of a Star or Planet.*

Look directly to the ſtar through the vane and tranſparent ſlit in the horizon-glaſs, move the index until the oppoſite horizon, with reſpect to the ſtar, is ſeen in the ſilvered part of the glaſs; and make the contact perfect as formerly. If the altitude of the ſtar is known nearly, the index may be ſet to that altitude, the ſight directed to the oppoſite horizon, and the obſervation made as before.

Sect. II. *Of finding the Latitude of a Place.*

The obſervation neceſſary for aſcertaining the latitude of a place, is that of the meridional altitude of a known celeſtial object; or two altitudes when the object is out of the meridian. The latitude is deduced with more certainty and with leſs trouble from the firſt of theſe methods, than from the ſecond; and the ſun, for various reaſons, is the object moſt proper for this purpoſe at ſea. It, however, frequently happens, that by the interpoſition of clouds, the ſun is obſcured at noon; and by this means the meridian altitude is loſt. In this caſe, therefore, the method by double altitudes becomes neceſſary. The latitude may be deduced from three altitudes of an unknown object, or from double altitudes, the apparent times of obſervation being given.

The altitude of the limb of an object obſerved at ſea, requires four ſeparate corrections in order to obtain the true altitude of its centre: theſe are for *ſemidiameter*, *dip*, *refraction*, and *parallax*. (See Astronomy, and the reſpective articles). The firſt and laſt of theſe corrections vaniſh when the obſerved object is a fixed ſtar.

When the altitude of the lower limb of any object is obſerved, its ſemidiameter is to be added thereto in order to obtain the central altitude; but if the upper limb be obſerved, the ſemidiameter is to be ſubtracted. If the altitude be taken by the back-obſervation, the contrary rule is to be applied. The dip is to be ſubtracted from, or added to, the obſerved altitude, according as the fore or back-obſervation is uſed. The refraction is always to be ſubtracted from, and the parallax added to, the obſerved altitude.

Prob. I. To reduce the ſun's declination to any given meridian.

Rule. Find the number in Table IX. anſwering to the longitude in the table neareſt to that given, and to the neareſt day of the month. Now, if the longitude is weſt, and the declination increaſing, that is, from the 20th of March to the 22d of June, and from the 22d of September to the 22d of December, the above number is to be added to the declination: during the other part of the year, or while the declination is decreaſing, this number is to be ſubtracted. In eaſt longitude, the contrary rule is to be applied.

Example I. Required the ſun's declination at noon 15th April 1793, in longitude 84° W?

Sun's declination at noon at Greenwich		10° 1′.8 N
Number from Table IX.	-	+ 5.0
Reduced declination	- -	10 6.8 N

Example II. Required the ſun's declination at noon 22d March 1793, in longitude 151° E?

Sun's declination at noon at Greenwich		0° 56′ N
Equation from table	- -	— 10
Reduced declination	-	0 46 N

Prob. II. Given the ſun's meridian altitude, to find the latitude of the place of obſervation.

Rule. The ſun's ſemidiameter is to be added to, or ſubtracted from, the obſerved altitude, according as the lower or upper limb is obſerved; the dip anſwering to the height from Table V. is to be ſubtracted if the fore-obſervation is uſed; otherwiſe, it is to be added; and the refraction anſwering to the altitude from Table IV. is to be ſubtracted: hence the true altitude of the ſun's centre will be obtained. Call the altitude ſouth or north, according as the ſun is ſouth or north at the time of obſervation; which ſubtracted from 90°, will give the zenith diſtance of a contrary denomination.

Reduce the ſun's declination to the meridian of the place of obſervation, by Problem I.; then the ſum or difference of the zenith diſtance and declination, according as they are of the ſame or of a contrary denomination, will be the latitude of the place of obſervation, of the ſame name with the greater quantity.

Example I. October 17th 1792, in longitude 32° E, the meridian altitude of the ſun's lower limb was 48° 53′ S, height of the eye 18 feet. Required the latitude?

Obs. alt. ſun's lower limb	48° 53′ S	Sun's dec. 17. Oct. noon.	9° 37′ S
Semidiameter	+0 16	Equation Table IX.	— 2
Dip and refraction	—0 5	Reduced declination	9 35 S
True alt. ſun's centre	49 4 S	Zenith diſtance	40 56 N
		Latitude	31 21 N

Example II. November 16th 1793, in longitude 158° W, the meridian altitude of the ſun's lower limb was 87° 37′ N, height of the eye 10 feet. Required the latitude?

Obs. alt. ſun's low. limb	87° 37′ N.	Sun's dec. noon.	18° 57′ S
Semidiameter	+0 16	Equation table	+0 8
Dip and refract.	— 0 3	Reduced dec.	19 5 S
True alt. ſun's centre	87 50 N.	Zenith diſtance	2 10 S
		Latitude	21 15 S

Example III. December 19th 1793, being nearly under the meridian of Greenwich, the altitude of the ſun's upper limb at noon was 4° 30′ S, height of the eye 20 feet. Required the latitude?

Obſerved altitude of the ſun's upper limb		4° 30′ S
Sun's ſemidiameter	- -	— 0 16
Dip and refraction	-	— 0 15
True altitude of the ſun's centre	-	3 59 S
Zenith diſtance	- -	86 1 N
Declination	- -	23 27 S
Latitude	- - -	62 34 N

Example

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EXAMPLE IV. Auguſt 23d 1793, in longitude 107 E, the meridian altitude of the ſun's lower limb by the back-obſervation was 61° 8′ N, and the height of the eye 14 feet. Required the latitude?

Obſerved altitude ſun's upper limb	61° 8′ N
Sun's ſemidiameter	−0 16
Dip	+0 3½
Refraction	−0 ½
True altitude of ſun's centre	60 55 N
Zenith diſtance	29 5 S
Reduced declination	11 20 N
Latitude	17 45 S

The dip in Table V. anſwers to an entirely open and unobſtructed horizon. It, however, frequently happens, that the ſun is over the land at the time of obſervation, and the ſhip nearer to the land than the viſible horizon would be if unconfined. In this caſe, the dip will be different from what it would otherwiſe have been, and is to be taken from Table VI. in which the height is expreſſed at the top, and the diſtance from the land in the ſide column in nautical miles.—Seamen, in general, can eſtimate the diſtance of any object from the ſhip with ſufficient exactneſs for this purpoſe, eſpecially when that diſtance is not greater than ſix miles, which is the greateſt diſtance of the viſible horizon from an obſerver on the deck of any ſhip.

PROB. III. Given the meridian altitude of a fixed ſtar, to find the latitude of the place of obſervation.

RULE. Correct the altitude of the ſtar by dip and refraction, and find the zenith diſtance of the ſtar as formerly; take the declination of the ſtar from Table XI. and reduce it to the time of obſervation. Now, the ſum or difference of the zenith diſtance and declination of the ſtar, according as they are of the ſame or of a contrary name, will be the latitude of the place of obſervation.

EXAMPLE I. December 1ſt 1793, the meridian altitude of Sirius was 59° 50′ S, height of the eye 14 feet. Required the latitude?

Obſerved altitude of Sirius	59° 50′ S
Dip and refraction	−0 4
True altitude	59 46 S
Zenith diſtance	30 14 N
Declination	16 27 S
Latitude	13 47 N

EXAMPLE II. February 17th 1797, the meridian altitude of Procyon was 71° 15′ N, the height of the eye 10 feet. Required the latitude?

Obſerved altitude of Procyon	71° 15′ N
Dip and refraction	−0 3
True altitude	71 12 N
Zenith diſtance	18 48 S
Declination	5 45 N
Latitude	13 3 S

PROB IV. Given the meridian altitude of a planet, to find the latitude of the place of obſervation.

RULE. Compute the true altitude of the planet as directed in laſt problem (which is ſufficiently accurate for altitudes taken at ſea); take its declination from the Nautical Almanac, page iv. of the month, and reduce it to the time and meridian of the place of obſervation; then the ſum or difference of the zenith diſtance and declination of the planet will be the latitude as before.

EXAMPLE I. December 10th 1792, the meridian altitude of Saturn was 68° 42′ N, and height of the eye 15 feet. Required the latitude?

Obſerved altitude of Saturn	68° 42′ N
Dip and refraction	−0 4
True altitude	68 38 N
Zenith diſtance	21 22 S
Declination	7 26 N
Latitude	13 56 S

EXAMPLE II. April 16th 1793, the meridian altitude of Jupiter was 81° 5′ S, height of the eye 18 feet. Required the latitude?

Obſerved altitude of Jupiter	81° 5′ S
Dip	−0 3
True altitude	81 2 S
Zenith diſtance	8 58 N
Declination	19 4 S
Latitude	10 6 S

PROB. V. Given the meridian altitude of the moon, to find the latitude of the place of obſervation.

RULE. Take the number † anſwering to the ſhip's longitude, and daily variation of the moon's paſſing the meridian; which being applied to the time of paſſage given in the Nautical Almanac, will give the time of the moon's paſſage over the meridian of the ſhip.

† *Mackay's Treatise on the Longitude*, Tab. XX.

Reduce this time to the meridian of Greenwich; and by means of the Nautical Almanac find the moon's declination, horizontal parallax, and ſemidiameter, at the reduced time.

Apply the ſemidiameter and dip to the obſerved altitude of the limb, and the apparent altitude of the moon's centre will be obtained; to which add the correction anſwering to the apparent altitude and horizontal parallax ‡, and the ſum will be the true altitude of the moon's centre; which ſubtracted from 90°, the remainder is the zenith diſtance, and the ſum or difference of the zenith diſtance and declination, according as they are of the ſame or of a contrary name, will be the latitude of the place of obſervation.

‡ Ditto, Tab. XX.

EXAMPLE I. December 24th 1792, in longitude 30° W, the meridian altitude of the moon's lower limb was 81° 15′ N, height of the eye 12 feet. Required the latitude?

Time of paſſ. over the mer. of Greenwich	= 9h 19′
Equation Table XX.	+0 4
Time of paſſ. over mer. ſhip	9 23
Longitude in time	2 0
Reduced time	11 23
Moon's dec. at midnight, Tab. IX.	= 14° 53 N
Eq. to time from midnight	−0 4
Reduced declination	14 49 N
Moon's hor. par.	55′ 25″

Moon's

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Moon's femidiameter	15 6
Augmentation	+0 14
Aug. femidiameter	15 20
Obferved altitude of the moon's lower limb	81° 15′ N
Semidiameter	+0 15
Dip	—0 3
Apparent altitude of the moon's centre	81 27 N
Correction	+0 8
True altitude of moon's centre,	81 35 N
Zenith diftance	8 25 S
Declination	14 49 N
Latitude	6 42 N

Example II. October 17th 1793, in longitude 8° W, the altitude of the moon's upper limb was 40° 27′ S, and height of the eye 20 feet. Required the latitude?

Time of paff. over mer. Greenwich	$=10^h\ 52'$
Equation to long.	0 0
Time of paff. over mer. fhip	10 52
Longitude in time	0 32
Reduced time	11 24
Moon's dec. at midnight	=0° 3′ N
Eq. to time from midnight	—0 3
Reduced declination	0 0
Moon's hor. parallax	60′ 29″
Moon's femidiameter	16 29
Augmentation	+0 12
Aug. femidiameter	16 41
Obferved altitude moon's lower limb	40° 27′ S
Semidiameter and dip	—0 21
Apparent altitude moon's centre	40 6
Correction	+0 45
True altitude moon's centre	40 51 S
Zenith diftance	49 9 N
Declination	0 0
Latitude	49 9 N

Remark. If the object be on the meridian below the pole at the time of obfervation, then the fum of the true altitude and the complement of the declination is the latitude, of the fame name as the declination or altitude.

Example I. July 1ft 1793, in longitude 15° W, the altitude of the fun's lower limb at midnight was 8° 58′, height of the eye 18 feet. Required the latitude?

Obferved altitude fun's lower limb	8° 58′
Semidiameter	+0 16
Dip and refraction	—0 10
True altitude of fun's centre	9 4 N
Compl. declin. reduced to time and place	66 57 N
Latitude	76 1 N

Example II. December 1ft 1798, the altitude of the pole ftar below the pole was 52° 20′ N, height of the eye 12 feet. Required the latitude?

Obferved altitude, pole ftar	52° 20′ N
Dip and refraction	—0 4
True altitude	52 16 N
Complement of declination	1 46
Latitude	54 2 N

Prob. VI. Given the latitude by account, the declination and two obferved altitudes of the fun, and the interval of time between them, to find the true latitude.

Rule. To the log. fecant of the latitude by account, add the log. fecant of the fun's declination; the fum, rejecting 20 from the index, is the *logarithm ratio.* To this add the log. of the difference of the natural fines of the two altitudes, and the log. of the half elapfed time from its proper column.

Find this fum in column of middle time, and take out the time anfwering thereto; the difference between which and the half elapfed time will be the time from noon when the greater altitude was obferved.

Take the log. anfwering to this time from column of rifing, from which fubtract the log. ratio, the remainder is the logarithm of a natural number; which being added to the natural fine of the greater altitude, the fum is the natural cofine of the meridian zenith diftance; from which and the fun's declination the latitude is obtained as formerly.

If the latitude thus found differs confiderably from that by account, the operation is to be repeated, ufing the computed latitude in place of that by account (L).

Example I. June 4th 1795, in latitude by account

(L) This method is only an approximation, and ought to be ufed under certain reftrictions; namely,

The obfervations muft be taken between nine o'clock in the forenoon and three in the afternoon. If both obfervations be in the forenoon, or both in the afternoon, the interval muft not be lefs than the diftance of the time of obfervation of the greateft altitude from noon. If one obfervation be in the forenoon and the other in the afternoon, the interval muft not exceed four hours and an half; and in all cafes, the nearer the greater altitude is to noon the better.

If the fun's meridian zenith diftance be lefs than the latitude, the limitations are ftill more contracted. If the latitude be double the meridian zenith diftance, the obfervations muft be taken between half paft nine in the morning and half paft two in the afternoon, and the interval muft not exceed three hours and an half. The obfervations muft be taken ftill nearer to noon, if the latitude exceeds the zenith diftance in a greater proportion. See *Mafkelyne's Britifh Mariner's Guide, and Requifite Tables*, 2d Ed.

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count 37° N at 10^h 29′ A. M. *per* watch, the corrected altitude of the sun was 65° 24′, and at 12^h 31′, the altitude was 74° 8′. Required the true latitude?

Times *per* wat.	Alt.	N. Sines.	Lat. by acc. 37° 0′ Secant	0.09765
10h 29′	65° 24′	90924	Declination 22 28 Secant	0.03428
12 31	74 8	96190	Logarithm ratio	0.13193
2 2	Differ.	5266	Logarithm	3.72148
1 1			Half elapsed time	0.57999
31 10″			Middle time -	4.43340
29 50			Rising - -	2.92740
			Log. ratio	0.13193
Natural number		-	624	2.79547
Greatest altitude	74° 8′ N. sine	96190		
Mer. zenith dist.	14 30 N. cosine	96814		
Declination	22 28			
Latitude	36 58 N.			

Example II. October 17th 1793, in latitude 43° 24′ N. by account, at 0^h 38′ P. M. the correct altitude of the sun's centre was 36° 5′, and at 2^h 46′ P. M. the altitude was 24° 49′. Required the latitude?

Times *per* wat.	Alt.	N. Sines.	Lat by acc. 43° 24′ Secant	0.13872
0h 38′	36° 5′	58896	Declination 9 32 Secant	0.00604
2 46	24 49	41972	Logarithm ratio	0.14476
2 8	Differ.	16924	Log.	4.22850
1 4			Half elapsed time	0.55966
1 41 30″			Middle time	4.93292
37 30			Rising	3.12570
			Log. ratio	0.14476
Natural number			957	2.98094
Greatest altitude	36° 5′ N. sine	58896		
Mer. zen. distance	53 14 N. cosine	39853		
Declination	9 32			
Latitude	43 42 N.			

Example III. August 25th 1793, in latitude 57° N. by account, in the morning the altitude of the sun's lower limb was 34° 22′, and 1^h 46′ after the altitude of the lower limb was 42° 12½′, the height of the eye 14 feet. Required the latitude?

First altitude	34° 22′	Second altitude	42° 12½′
Sun's semidiameter	+0 16	Semidiameter	+0 16
Dip and refraction	—0 5	Dip and refract.	—0 4½
Corrected altitude	34 33	Corrected altit.	42 24

Interval of time.	Altit.	N. Sines.	Lat. by acc. 57° 0′ Secant.	0.26389
	34° 33′	56713	Declination 10 33 Secant.	0.00741
	42 24	67430	Logarithm ratio	0.27130
1h 46′	Difference	10717	Log.	4.03007
53 0″			Half elapsed time	0.63978
1 43 30			Middle time	4.94115
50 30			Rising	3.38343
			Log. ratio	0.27130
Natural number			1295	3.11213
Greatest altitude	42° 24′ N. sine	67430		
Mer. zen. distance	46 35 N. cosine	68725		
Declination	10 33			
Latitude	57 8 N.			

8

The greatest altitude was observed 50′½ before 12 or at 11^h 9′½; hence the first altitude was observed at 9^h 23½ A. M.

Example IV. In latitude 49° 48′ N. by account, the sun's declination being 9° 37′ S. at 0^h 32′ P. M. *per* watch, the altitude of the sun's lower limb was 28° 32′, and at 2^h 41′ it was 19° 25′, the height of the eye 12 feet. Required the true latitude?

First observed altit.	28° 32′	Second altitude	19° 25′
Semidiameter	+0 16	Semidiameter	+0 16
Dip and refraction	—0 5	Dip and refr.	—0 6
True altitude	28 43	True altitude	19 35

Time *per* wat.	Alt.	N. Sines.	Lat. by acc. 49° 48′ Secant.	0.19013
0h 32′	28° 43′	48048	Declination 9 37 Secant	0.00615
2 41	19 35	33518	Log. ratio - -	0.09628
2 9	Difference	14530	Log. -	4.16227
1 4 30″			Half elapsed time	0.55637
1 37 0			Middle time	4.91492
32 30			Rising	3.00164
Natural number		639		2.80556
Mer. zen. dist.	60° 52′ N. cosine	48687		
Declination	9 37 S.			
Latitude	51 15 N.			

As the latitude by computation differs 1° 27′ from that by account, the operation must be repeated.

Computed latitude	51° 15′	Secant	0.20348
Declination	9 37	Secant	0.00615
Logarithm ratio	-	-	0.20963
Difference of nat. sines	14530	Log.	4.16227
Half elapsed time	1^h 4′ 30″	Log.	0.55637
Middle time	1 40 20	Log.	4.92827
Rising -	0 35 50	Log.	3.08630
Natural number	753		2.87667
Gr. altitude	28° 43′ N. sine 48048		
Mer. zen. dist.	60 47 N. cosine 48801		
Declination	9 37		
Latitude	51 10 N.		

As this latitude differs only 5′ from that used in the computation, it may therefore be depended on as the true latitude.

Prob. VII. Given the latitude by account, the sun's declination, two observed altitudes, the elapsed time, and the course and distance run between the observations; to find the ship's latitude at the time of observation of the greater altitude.

Rule. Find the angle contained between the ship's course and the sun's bearing at the time of observation of the least altitude, with which enter the Traverse Table as a course, and the difference of latitude answering to the distance made good will be the reduction of altitude.

Now, if the least altitude be observed in the forenoon, the reduction of altitude is to be applied thereto by addition or subtraction, according as the angle between

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between the ship's course and the sun's bearing is less or more than eight points. If the least altitude be observed in the afternoon, the contrary rule is to be used.

The difference of longitude in time between the observations is to be applied to the elapsed time by addition or subtraction, according as it is east or west. This is, however, in many cases so inconsiderable as to be neglected.

With the corrected altitudes and interval, the latitude by account and sun's declination at the time of observation of the greatest altitude, the computation is to be performed by the last problem.

Example I. July 6th 1793, in latitude 58° 14′ N. by account, and longitude 16° E. at 10^h 54′ A. M. *per* watch, the altitude of the sun's lower limb was 53° 17′, and at 1^h 17′ P. M. the altitude was 52° 51′, and bearing *per* compass SW*b*W; the ship's course during the elapsed time was S*b*W½W, and the hourly rate of sailing 8 knots, the height of the eye 16 feet. Required the true latitude at the time of observation of the greater altitude?

Sun's bear. at 2d ob. SW*b*W. Interval bet. observ. 2^h 23′
Ship's course S*b*W½W Dist. run $=2^h 23 \times 8 = 19$m.

Contained angle 3½ points.

Now to course 3½ points and distance 19 miles, the difference of latitude is 14.7 or 15 miles.

First observed alt.	53°	17′	Second observed alt.	52°	51′	
Semidiameter	+0	16	Semidiameter	+0	16	
Dip and refract.	—0	4	Dip and refraction	—0	4	
True altitude	53	29	Reduction	—0	15	
			Reduced altitude	52	48	

Time of ob. of gr. alt. 10^h 54′ A. M. Sun's dec. 22° 39′ N.
Longitude in time 1 4 Eq. to r. t. + 1

Reduced time 9 50 A. M. Red. decl. 22 40 N.

Time *per* wat.	Alt.	N. Sines.			
			Lat. by acc. 58° 14′	Secant.	0.27863
10h 54′	53° 29′	80368	Declination 22 40	Secant.	0.03491
1 17	52 48	79653	Logarithm ratio		0.31354
2 23	Difference	715		Log.	2 85431
1 11 30″			Half elapsed time		0.51294
5 30			Middle time		3.68079
1 6 0			Rising		3.61469
			Log. ratio		0.31354
Natural number		2001			3.30115
Greatest altitude	53° 29′ N. sine	80368			
Mer. zen. distance	34 33 N	cosine 82369			
Declination	22 40 N.				
Latitude	57 13 N.				

Since the computed latitude differs so much from that by account, it will be necessary to repeat the operation.

Computed latitude	57° 13′	Secant	0.26643
Declination	22 40	Secant	0.03491
Logarithm ratio			0.30134
Difference of natural sines	715	Log.	2.85431
Half elapsed time	1^h 11′ 30″	Log.	0.51294
Middle time	5 20	Log.	3.66859
Rising	1 6 10	Log.	3.61686
Logarithm ratio			0.30134
Natural number	2068		3.31552
Greatest altitude	53° 29′ N. sine	80368	
Mer. zen. dist.	34 29 N.	cosine 82436	
Declination	22 40 N.		
Latitude	57 9 N.		

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As this latitude differs only 4 miles from that used in the computation, it may therefore be depended on as the true latitude.

Example II. Sept. 13th 1793, in latitude 38° 12′ N by account, and longitude 14° E. at 9^h 28′ A. M. *per* watch, the altitude of the sun's lower limb was 40° 42′, and azimuth *per* compass SE¼E, at 11^h 16′ A. M. the altitude was 53° 11′; the ship's course during the elapsed time was W½N at the rate of 9 knots an hour, and height of the eye 12 feet. Required the ship's true latitude at the time of the second observation?

Sun's bear. at first obs. SE. ¼ E. Elaps. time 1h. 48′
Ship's course, W½N. D. run $= 1h 48' \times 9 = 16$m

Contained angle 11¼ points; supplement 4¼ pts.

To course 4¼ points, and distance run 16 miles, the difference of latitude is 10′.7, or 11 miles.

First observed alt.	40°	42′	Second obs. alt.	53°	11	
Sun's semidiameter	+0	16′	Semidiameter	+0	16	
Dip and refraction	—0	4	Dip and refr.	—0	4	
Reduction of alt.	—0	11	Corrected alt.	53	23	
Reduced altitude,	40	43				

Time of ob. great. alt. 11h 16′ Sun's dec. at noon 3 32⅓
Longitude in time, 0 56 Eq. to time from n. + 1⅔

Reduced time, 10 20 Reduced declin. 3 34

Time *per* Watch.	Alt.	N. Sine			
			Lat. by acc 38° 12′	Secant	0.10466
9h 28′	40° 43′	65232	Declination 3 34	Secant	0.00084
11 16	53 23	80264	Logarithm ratio	-	0.10550
1 48	Differ.	15032	Log.	-	4.17702
0 54			Half elapsed time	-	0.63181
1 37			Middle time	-	4.91333
0 43			Rising	-	3.24427
Natural number		1376			3.13677
Mer Zen. dist. 35° 16′ N.		cosine 81640			
Declination	3 34			Secant	0.00084
Latitude	38 50			Secant	0.10848

Logarithm ratio	-		0.10932
Difference of natural sines	15032	Log.	4.17702
Half elapsed time	oh 54′ 0″	Log	0.63181
Middle time	1 37 50	Log.	4.91815
Rising	0 43 10	Log.	3.26089
Natural number	1418		3.15157

Greatest

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Greateſt altitude	53° 23′	N. ſine 80264
Mer. Zen. diſt.	35 14	N. coſine 81682
Declination	3 34	
Latitude -	38 48 N.	

This latitude differing only 2 miles from that uſed in the computation, may therefore be relied on as the true latitude.

Remark. If the ſun comes very near the zenith, the ſines of the altitude will vary ſo little as to make it uncertain which ought to be taken as that belonging to the natural ſine of the meridian altitude. In this caſe, the following method will be found preferable

To the log. riſing of the time from noon found as before, add the log. ſecant of half the ſum of the eſtimate meridian altitude, and greateſt obſerved altitude; from which ſubtract the log. ratio, its index being increaſed by 10, and the remainder will be the log. ſine of an arch; which added to the greateſt altitude will give the ſun's meridian altitude.

Example. December 21ſt 1793, in latitude 22° 40′ S, by account, at 11^h 57′ the correct altitude of the ſun's centre was 89° 10′, and at 12^h 4′ 40″, the altitude was 88° 50′. Required the true latitude?

Times *per* Watch.	Alt.	N. Sines.			
11h 57′ 0″	89° 10′	99989	Lat. by acc.	22° 40′	Sec. 0.03491
			Declination	23 28	Sec. 0.03749
12 4 40	88 50	99979	Logarithm ratio		0.07240
0 7 10	Difference	10	log.		1.00000
0 3 50			Half elapſed time		1.77663
0 0 50			Middle time		2.84903
0 3 0			Riſing		0.93284

Comp. of lat. by acc.	67° 20′		
Declination	23 28		
Sum	90 48		
Eſtimate mer. altitude	89 12	89° 11′ ſec.	11.84609
Greateſt altitude	89 10		
			12.77893
Logarithm ratio + 5			5.07240
Arch	0 17′	ſine	7.70653
Greateſt altitude	89 10		
Meridian altitude	89 27	zen. diſt.	0 33′ N
		declination	23 28 S
		latitude	22 55 S

This differing from the aſſumed latitude, the work muſt be repeated.

Latitude	22° 55′	ſecant	0.03571
Declination	23 28	ſecant	0.03749
Logarithm ratio			0.07320
Difference of natural ſines,	1°	log.	1.00000
Half elapſed time	3′ 50″		1.77663
Middle time	0 50		2.84983
Riſing	3 0		0.93284
Comp. of lat.	67° 5′		
Declination	23 28		
Sum	90 33		
Mer. alt.	89 27	89° 18′½ ſec.	11.91827
Greateſt alt.	89 10		
			12.85111
Log. ratio + 5			5.07320
Arch	0 21		7.77791
Greateſt altitude	89 10		
Merid. altitude	89 31	zen. diſt.	0° 29′
		Declination	23 28
		Latitude	22 59 S

If the work be repeated with this laſt latitude, the latter part only may be altered.

Latitude	22° 59′	ſecant	0.03592
Declination	23 28	ſecant	0.03749
Eſt. mer. alt.	89 31	log. ratio	0.07341
Greateſt altitude	89 10	ar. com. — 5	4.92659
Sum	178 41		
Half	89 20½	ſecant	1.93972
Riſing			0.93284
Arch	0 22	ſine	7.79915
Greateſt altitude	89 10		
Meridian altitude	89 32		
Zenith diſtance	0 28		
Declination	23 28		
Latitude	23 0 S.		

Prob. VIII. To find the latitude from double altitudes of the ſun and the elapſed time; one of theſe obſervations being taken near the eaſt or weſt points, and the other near the meridian.

Rule. With the latitude by account, the ſun's declination and leaſt altitude, compute the apparent time of obſervation by Problem VII. of next chapter. From whence and the interval of time between the obſervations, the time from noon when the greateſt altitude was obſerved will be known. To the logarithm riſing of which, add the logarithmic coſines of the ſun's declination and the latitude of the place by account; the ſum will be the logarithm of a natural number, which added to the natural ſine of the greater altitude, will give the natural coſine of the meridian zenith diſtance; and hence the latitude is found as formerly.

Or the time from noon being found, the latitude may be computed by the rule given in the preceding remark.

Example. September 1ſt 1793, in latitude 40° 0′ N by account, at 6^h 5′ A. M. per watch, the altitude of the ſun's lower limb was 16° 21′, and at 11^h 41′ the altitude was 57° 42′; the height of the eye 18 feet. Required the latitude?

Firſt alt.	16° 21′	Second alt.	57° 42′
Sun's ſemidia. +	0 16	Sun's ſemidia. +	0 16
Dip and refr. —	0 7	Dip and refrac. —	0 5
True altitude	16 30	True altitude	57 53

Lat.

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Lat. by acc.	40 0 N	Secant		0.11575
Declination	8 3 N	Secant		0.00430
Difference	31 57	nat. cosine	84851	
Altitude	16 30	nat. sine	28402	
		Difference	56449	4.75165

Time from noon of first obs.	5h 0′ 40″	rising	4.87170
Interval of time between obs.	4 45 0		
Time from noon of 2d obs.	0 15 40	rising	2.36839
Latitude by acc.	40° 0′	cosine	9.88425
Declination	8 3	cosine	9.99670
Natural number		178	2.24934
Greater altitude	57 53	nat. sine 84697	
Merid. zen. dist.	31 55	nat. cosine 84875	
Declination	8 3		
Latitude	39 58 N.		

Prob. IX. Given the altitudes of two known stars, observed at the same or at different times; and if at different times, the interval between the observations; to find the latitude.

Rule. If both altitudes be observed at the same time, call the difference between their right ascensions the reduced interval.

But if the altitudes be taken at different times, reduce the interval between the observations to sidereal time, by adding thereto the proportional part answering to the interval, and 3′ 56″, the daily acceleration of the fixed stars. Now to the right ascension of the first observed star, add the interval in sidereal time, and the difference between this sum and the right ascension of the other star will be the reduced interval.

To the logarithm rising of the reduced interval, add the logarithmic cosines of the stars declinations; subtract the natural number answering to the sum of these logarithms from the natural cosine of the difference or sum of the stars declinations, according as they are of the same or of a contrary name, and the remainder will be the natural sine of arch first.

To the logarithmic cosine of arch first add the logarithmic secant of declination of the star having the least polar distance, and the logarithm half elapsed time of the reduced interval, the sum will be the logarithm half elapsed time of arch second.

From the natural cosine of the difference between arch first and the altitude of the star having the greatest polar distance, subtract the natural sine of the altitude of the other star, and find the logarithm of the remainder; to which add the logarithm secant of arch first, and the logarithmic secant of the altitude of the star having the greatest polar distance, the sum will be the logarithm rising of arch third. The difference between arches second and third is arch fourth.

To the logarithm rising of arch fourth add the logarithmic cosines of the declination and altitude of the star having the greatest polar distance; subtract the corresponding natural number from the natural cosine of the difference between the altitude and declination, the polar distance being less than 90°; otherwise, from their sum, and the remainder will be the natural sine of the latitude.

Example I. January 1st 1793, the true altitude of Capella was 69° 23′, and at the same instant the true altitude of Sirius was 16° 19′. Required the latitude?

Right ascension of Capella	5h 1′ 25″			
Right ascension of Sirius	6 36 1			
Interval	1 34 36			
Interval	1h 34′ 36″	rising		3.92270
Capella's declin.	45° 46′ N	cosine		9.84 60
Sirius's declin.	16 27 S	cosine		9.98185
Sum	62 13 N	cosine	46613	
			5599	3.74815
Arch first	24 13 N	sine	41014 cos.	9.96000
Capella's declin.	45 46	secant		0.15640
Interval	1h 34′ 36″	H. E. time		0.39670
Arch second	1 11 28	H. E. time		0.51310
Arch first	24 13	secant		0.04000
Sirius's altitude	16 19	secant		0.01785
Difference	7 54 N.	cosine	99051	
Capella's altitude	69 23 N	sine	93596	
			5455	3.73679
Arch third	1h 21′ 20″	rising		3.79464
Arch second	1 11 28			
Arch fourth	9 52	rising		1.96708
Sirius's declin.	16 27	cosine		9.98185
altitude	16 19	cosine		9.98215
Sum	32 46 N	cos.	84088	
			85	1.93008
Latitude	57 9 N	sine	84003	

Example II. In north latitude, Decem. 30th 1793, the true altitude of Menkar was 43° 38′; and 1h 18′ after the altitude of Rigel was 29° 51′. Required the latitude?

Observed Interval	1h 18′ 0″			
Equation	+ 0 0 13			
Inter. in sid. time	1 18 13			
Right as. of Menkar	2 51 31			
Sum	4 9 44			
Right asc. of Rigel	5 4 34			
Reduced interval	0 54 50	rising		3.45462
Declin. of Menkar	3 16½ N	cosine		9.99929
Declin. of Rigel	8 27 S	cosine		9.99526
Sum	11 43½ N	co.	97913	
			2813	3.44917
Arch first	71 59 N	sine	95100 co.	9.49037
Declin. of Menkar	3 16½	secant		0.00071
Reduced interval	0 54 50	H. E. time		0.62529
Arch second	3 19 36	H. E. time		0.11637

Arch

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Arch firft	71° 59′	fecant	0.50963
Altitude Rigel	29 51	fecant	0.06181
Difference	42 8 N	cofine 74159	
Alt. of Menkar	43 38 N	fine 69004	
		Difference 5155	3.71223
Arch third	2h 24′ 27″	rifing	4.28367
Arch fecond	3 19 36		
Arch fourth	0 55 9	rifing	3.45960
Declin. of Rigel	8 27 S	cofine	9.99526
Alt. of Rigel	29 51	cofine	9.93819
Sum	38 18 N	cofine 78478	
		2472	3.39305
Latitude	49 28 N	fine 76006	

Chap. II. *Containing the Method of finding the Longitude at Sea by Lunar Obfervations.*

Sect. I. *Introduction.*

The obfervations neceffary to determine the longitude by this method are, the diftance between the fun and moon, or the moon and a fixed ftar near the ecliptic, together with the altitude of each. The ftars ufed in the Nautical Almanac for this purpofe are the following: namely, α *Arietis*, *Aldebaran*, *Pollux*, *Regulus*, *Spica Virginis*, *Antares*, α *Aquilæ*, *Fomalhaut*, and α *Pegafi*; and the diftances of the moon's centre from the fun, and from one or more of thefe ftars, are contained in the viii. ix. x. and xi. pages of the month, at the beginning of every third hour apparent time, by the meridian of Greenwich. The diftance between the moon and the fun, or one of thefe ftars, is obferved with a fextant; and the altitudes of the objects are taken as ufual with a Hadley's quadrant.

In the practice of this method, it will be found convenient to be provided with three affiftants; two of thefe are to take the altitudes of the fun and moon, or moon and ftar, at the fame time the principal obferver is taking the diftance between the objects; and the third affiftant is to obferve the time, and write down the obfervations. In order to obtain accuracy, it will be neceffary to obferve feveral diftances, and the correfponding altitudes; the intervals of time between them being as fhort as poffible; and the fum of each divided by the number will give the mean diftance and mean altitudes; from which the time of obfervation at Greenwich is to be computed by the rules to be explained.

If the fun or ftar from which the moon's diftance is obferved be at a proper diftance from the meridian, the time at the fhip may be inferred from the altitude obferved at the fame time with the diftance: in this cafe, the watch is not neceffary; but if that object be near the meridian, the watch is abfolutely neceffary, in order to connect the obfervations for afcertaining the apparent time at the fhip and the longitude with each other.

An obferver without any affiftants may very eafily take all the obfervations, by firft taking the altitudes of the objects, then the diftance, and again their altitudes, and reduce the altitudes to the time of obfervation of the diftance; or, by a fingle obfervation of the diftance, the apparent time being known, the longitude may be determined.

A fet of obfervations of the diftance between the moon and a ftar, and their altitudes, may be taken with accuracy during the time of the evening or morning twilight; and the obferver, though not much acquainted with the ftars, will not find it difficult to diftinguifh the ftar from which the moon's diftance is to be obferved. For the time of obfervation nearly, and the fhip's longitude by account being known, the eftimate time at Greenwich may be found; and by entering the Nautical Almanac with the reduced time, the diftance between the moon and given ftar will be found nearly. Now fet the index of the fextant to this diftance, and hold the plane of the inftrument fo as to be nearly at right angles to the line joining the moon's cufps, direct the fight to the moon, and by giving the fextant a flow vibratory motion, the axis of which being that of vifion, the ftar, which is ufually one of the brighteft in that part of the heavens, will be feen in the filvered part of the horizon-glafs.

Sect. II. *Of the Sextant.*

This inftrument is conftructed for the exprefs purpofe of meafuring with accuracy the angular diftance between the fun and moon, or between the moon and a fixed ftar, in order to afcertain the longitude of a place by lunar obfervations. It is, therefore, made with more care than the quadrant, and has fome additional appendages that are wanting in that inftrument.

Fig. 74. reprefents the fextant, fo framed as not to be liable to bend (M). The arch AA is divided into 120 degrees, each degree is divided into three parts; each of thefe parts, therefore, contains 20 minutes, which are again fubdivided by the vernier into every half minute or 30 feconds. The vernier is numbered at every fifth of the longer divifions, from the right towards the left, with 5, 10, 15, and 20; the firft divifion to the right being the beginning of the fcale. Plate CCCXLIII.

In order to obferve with accuracy, and make the images come precifely in contact, an adjufting fcrew B is added to the index, which may thereby be moved with greater accuracy than it can be by hand; but this fcrew does not act until the index is fixed by the finger fcrew C. Care fhould be taken not to force the adjufting fcrew when it arrives at either extremity of its adjuftment. When the index is to be moved any confiderable quantity, the fcrew C at the back of the fextant muft be loofened; but when the index is brought nearly to the divifion required, this back fcrew fhould be tightened, and then the index may be moved gradually by the adjufting fcrew.

 There

(M) Troughton's patent double-framed fextants are not liable to bend.

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There are four tinged glasses D, each of which is set in a separate frame that turns on a centre. They are used to defend the eye from the brightness of the solar image and the glare of the moon, and may be used separately or together as occasion requires.

There are three more such glasses placed behind the horizon-glass at E, to weaken the rays of the sun or moon when they are viewed directly through the horizon-glass. The paler glass is sometimes used in observing altitudes at sea, to take off the strong glare of the horizon.

The frame of the index-glass I is firmly fixed by a strong cock to the centre plate of the index. The horizon-glass F is fixed in a frame that turns on the axes or pivots, which move in an exterior frame; the holes in which the pivots move may be tightened by four screws in the exterior frame. G is a screw by which the horizon-glass may be set perpendicular to the plane of the instrument: should this screw become loose or move too easy, it may be easily tightened by turning the capstan-headed screw H, which is on one side of the socket through which the stern of the finger screw passes.

Plate CCCXLIII.

The sextant is furnished with a plain tube (fig. 75.) without any glasses; and to render the objects still more distinct, it has two telescopes, one (fig. 76.) representing the objects erect, or in their natural position: the longer one (fig. 77.) shows them inverted; it has a large field of view and other advantages, and a little use will soon accustom the observer to the inverted position, and the instrument will be as readily managed by it as by the plain tube alone. By a telescope the contact of the images is more perfectly distinguished; and by the place of the images in the field of the telescope, it is easy to perceive whether the sextant is held in the proper place for observation. By sliding the tube that contains the eye-glasses in the inside of the other tube, the object is suited to different eyes, and made to appear perfectly distinct and well defined.

The telescopes are to be screwed into a circular ring at K; this ring rests on two points against an exterior ring, and is held thereto by two screws; by turning one or other of these screws, and tightening the other, the axis of the telescope may be set parallel to the plane of the sextant. The exterior ring is fixed on a triangular brass stem that slides in a socket, and by means of a screw at the back of the quadrant may be raised or lowered so as to move the centre of the telescope to point to that part of the horizon-glass which shall be judged the most fit for observation. Fig. 78. is a circular head, with tinged glasses to screw on the eye-end of either of the telescopes or the plain tube. The glasses are contained in a circular plate which has four holes; three of these are fitted with tinged glasses, the fourth is open. By pressing the finger against the projecting edge of this plate, and turning it round, the open hole, or any of the tinged glasses, may be brought between the eye-glass of the telescope and the eye.

Fig. 79. is a magnifying glass, to assist the observer to read off the angle with more accuracy; and (fig. 80.) a screw-driver.

Adjustments of the Sextant.

The adjustments of a sextant are, to set the mirrors perpendicular to its plane and parallel to each other when the index is at Zero, and to set the axis of the telescope parallel to the plane of the instrument. The three first of these adjustments are performed nearly in the same manner as directed in the section on the quadrant: as, however, the sextant is provided with a set of coloured glasses placed behind the horizon-glass, the index error may be more accurately determined by measuring the sun's diameter twice, with the index placed alternately before and behind the beginning of the divisions: half the difference of these two measures will be the index-error, which must be added to, or subtracted from, all observations, according as the diameter measured with the index to the left of 0 is less or greater than the diameter measured with the index to the right of the beginning of the divisions.

Adjustment IV. *To set the Axis of the Telescope parallel to the Plane of the Instrument.*

Turn the eye end of the telescope until the two wires are parallel to the plane of the instrument; and let two distant objects be selected, as two stars of the first magnitude, whose distance is not less than 90° or 100°; make the contact of these objects as perfect as possible at the wire nearest the plane of the instrument; fix the index in this position; move the sextant till the objects are seen at the other wire, and if the same points are in contact, the axis of the telescope is parallel to the plane of the sextant; but if the objects are apparently separated, or do partly cover each other, correct half the error by the screws in the circular part of the supporter, one of which is above and the other between the telescope and sextant; turn the adjusting screw at the end of the index till the limbs are in contact; then bring the objects to the wire next the instrument; and if the limbs are in contact, the axis of the telescope is adjusted; if not, proceeed as at the other wire, and continue till no error remains.

It is sometimes necessary to know the angular distance between the wires of the telescope: to find which, place the wires perpendicular to the plane of the sextant, hold the instrument vertical, direct the sight to the horizon, and move the sextant in its own plane till the horizon and upper wire coincide; keep the sextant in this position, and move the index till the reflected horizon is covered by the lower wire; and the division shown by the index on the limb, corrected by the index error, will be the angular distance between the wires. Other and better methods will readily occur to the observer at land.

Use of the Sextant.

When the distance between the moon and the sun or a star is to be observed, the sextant must be held so that its plane may pass through the eye of the observer and both objects; and the reflected image of the most luminous of the two is to be brought in contact with the other seen directly. To effect this, therefore, it is evident, that when the brightest object is to the right of the other, the face of the sextant must be held upwards; but if to the left, downwards. When the face of the sextant is held upwards, the instrument should be supported with the right hand, and the index moved with the left hand. But when the face of the sextant is from the observer, it should be held with the

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the left hand, and the motion of the index regulated by the right hand.

Sometimes a sitting posture will be found very convenient for the observer, particularly when the reflected object is to the right of the direct one: in this case, the instrument is supported by the right hand, the elbow may rest on the right knee, the right leg at the same time resting on the left knee.

If the sextant is provided with a ball and socket, and a staff, one of whose ends is attached thereto, and the other rests in a belt fastened round the body of the observer, the greater part of the weight of the instrument will by this means be supported by his body.

To observe the Distance between the Moon and any celestial Object.

1. Between the sun and moon.

Put the telescope in its place, and the wires parallel to the plane of the instrument; and if the sun is very bright, raise the plate before the silvered part of the speculum; direct the telescope to the transparent part of the horizon-glass, or to the line of separation of the silvered and transparent parts according to the brightness of the sun, and turn down one of the coloured glasses; then hold the sextant so that its plane produced may pass through the sun and moon, having its face either upwards or downwards according as the sun is to the right or left of the moon; direct the sight through the telescope to the moon, and move the index till the limb of the sun is nearly in contact with the enlightened limb of the moon; now fasten the index, and by a gentle motion of the instrument make the image of the sun move alternately past the moon; and, when in that position where the limbs are nearest each other, make the coincidence of the limbs perfect by means of the adjusting screw: this being effected, read off the degrees and parts of a degree shown by the index on the limb, using the magnifying glass; and thus the angular distance between the nearest limbs of the sun and moon is obtained.

2. Between the moon and a star.

Direct the middle of the field of the telescope to the line of separation of the silvered and transparent parts of the horizon-glass; if the moon is very bright, turn down the lightest coloured glass, and hold the sextant so that its plane may be parallel to that passing through the eye of the observer and both objects; its face being upwards if the moon is to the right of the star, but if to the left, the face is to be held from the observer; now direct the sight through the telescope to the star, and move the index till the moon appears by reflection to be nearly in contact with the star; fasten the index, and turn the adjusting screw till the coincidence of the star and enlightened limb of the moon is perfect: and the degrees and parts of a degree shown by the index will be the observed distance between the moon's enlightened limb and the star.

The contact of the limbs must always be observed in the middle between the parallel wires.

It is sometimes difficult for those not much accustomed to observations of this kind, to find the reflected image in the horizon-glass: it will perhaps in this case be found more convenient to look directly to the object, and, by moving the index, to make its image coincide with that seen directly.

Sect. III. *Of the Circular Instrument of Reflection.*

This instrument was proposed with a view to correct the errors to which the sextant is liable; particularly the error arising from the inaccuracy of the divisions on the limb. It consists of the following parts; a circular ring or limb, two moveable indices, two mirrors, a telescope, coloured glasses, &c.

The limb of this instrument is a complete circle of metal, and is connected with a perforated central plate by six radii: it is divided into 720 degrees; each degree is divided into three equal parts; and the division is carried to minutes by means of the index scale as usual.

The two indices are moveable about the same axis, which passes exactly through the centre of the instrument:—the first index carries the central mirror, and the other the telescope and horizon-glass; each index being provided with an adjusting screw for regulating its motion, and a scale for showing the divisions on the limb.

The central mirror is placed on the first index immediately above the centre of the instrument, and its plane makes an angle of about 30° with the middle line of the index. The four screws in its pedestal for making its plane perpendicular to that of the instrument have square heads, and are therefore easily turned either way by a key for that purpose.

The horizon-glass is placed on the second index near the limb, so that as few as possible may be intercepted of the rays proceeding from the reflected object when to the left. The perpendicular position of this glass is rectified in the same manner as that of the horizon-glass of a sextant, to which it is similar. It has another motion, whereby its plane may be disposed so as to make a proper angle with the axis of the telescope, and a line joining its centre, and that of the central mirror.

The telescope is attached to the other end of the index. It is an achromatic astronomical one, and therefore inverts objects; it has two parallel wires in the common focus of the glasses, whose angular distance is between two and three degrees; and which, at the time of observation, must be placed parallel to the plane of the instrument. This is easily done, by making the mark on the eye-piece coincide with that on the tube. The telescope is moveable by two screws in a vertical direction with regard to the plane of the instrument, but is not capable of receiving a lateral motion.

There are two sets of coloured glasses, each set containing four, and differing in shade from each other. The glasses of the larger set, which belongs to the central mirror, should have each about half the degree of shade with which the correspondent glass of the set belonging to the horizon mirror is tinged. These glasses are kept tight in their places by small pressing screws, and make an angle of about 85° with the plane of the instrument; by which means the image from the coloured glass is not reflected to the telescope. When the angle to be measured is between 5° and 34°, one of the glasses of the largest set is to be placed before the horizon-glass.

The handle is of wood, and is screwed to the back of the instrument, immediately under the centre, with which it is to be held at the time of observation.

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Fig. 81. is a plan of the inftrument, wherein the limb is reprefented by the divided circular plate; A is the central mirror, *a a*, the places which receive the ftems *a a* of the glafs fig. 84; EF, the firft or central index, with its fcale and adjufting fcrew; MN, the fecond or horizon index; GH, the telefcope; IK, the fcrews for moving it towards or from the plane of the inftrument; C, the place of the coloured glafs fig. 83; and D, its place in certain obfervations.

Fig. 82. is a fection of the inftrument, wherein the feveral parts are referred to by the fame letters as in fig. 81: Fig. 83. reprefents one of the horizon coloured glaffes; and fig. 84. one of the central coloured glaffes: Fig. 85. is the key for turning the adjufting fcrews of the mirrors: Fig. 86. is the handle: Fig. 87. a fection of one of the radii towards its middle: Fig. 88. is ufed in fome terreftrial obfervations for diminifhing the light of the direct object, whofe place at the time of obfervation is D: Fig. 89. is the tool for adjufting the central mirror, and for rectifying the pofition of the telefcope with regard to the plane of the inftrument; there is another tool exactly of the fame fize. The height of thefe is nearly equal to that of the middle of the central mirror.

Adjuftments of the Circular Inftrument.

I. *To fet the horizon-glafs fo that none of the rays from the central mirror fhall be reflected to the telefcope from the horizon mirror, without paffing through the coloured glafs belonging to this laft mirror.*—Place the coloured glafs before the horizon mirror; direct the telefcope to the filvered part of that mirror, and make it nearly parallel to the plane of the inftrument; move the firft index; and if the rays from the central mirror to the horizon-glafs, and from thence to the telefcope, have all the fame degree of fhade with that of the coloured glafs ufed, the horizon-glafs is in its proper pofition; otherwife the pedeftal of the glafs muft be turned until the uncoloured images difappear.

II. Place the two adjufting tools on the limb, about 350° of the inftrument diftant, one on each fide of the divifion on the left, anfwering to the plane of the central mirror produced: then the eye being placed at the upper edge of the neareft tool, move the central index till one half only of the reflected image of this tool is feen in the central mirror towards the left, and move the other tool till its half to the right is hid by the fame edge of the mirror; then, if the upper edges of both tools are apparently in the fame ftraight line, the central mirror is perpendicular to the plane of the inftrument; if not, bring them into this pofition by the fcrews in the pedeftal of the mirror.

III. *To fet the horizon mirror perpendicular to the plane of the inftrument.*—The central mirror being previoufly adjufted, direct the fight through the telefcope to any well defined diftant object; then if, by moving the central index, the reflected image paffes exactly over the direct object, the mirror is perpendicular; if not, its pofition muft be rectified by means of the fcrews in the pedeftal of the glafs.

A planet, or ftar of the firft magnitude, will be found a very proper object for this purpofe.

IV. *To make the line of collimation parallel to the plane of the inftrument.*—Lay the inftrument horizontally on a table; place the two adjufting tools on the limb, towards the extremities of one of the diameters of the inftrument; and at about 15 or 20 feet diftant let a well defined mark be placed, fo as to be in the fame ftraight line with the tops of the tools; then raife or lower the telefcope till the plane paffing through its axis and the tops of the tools is parallel to the plane of the inftrument, and direct it to the fixed object; turn either or both of the fcrews of the telefcope till the mark is apparently in the middle between the wires; then is the telefcope adjufted; and the difference, if any, between the divifions pointed out by the indices of the fcrews will be the error of the indices. Hence this adjuftment may in future be eafily made.

In this procefs the eye tube muft be fo placed as to obtain diftinct vifion.

V. *To find that divifion to which the fecond index being placed the mirrors will be parallel, the central index being at Zero.*—Having placed the firft index exactly to *o*, direct the telefcope to the horizon mirror, fo that its field may be bifected by the line of feparation of the filvered and tranfparent parts of that mirror; hold the inftrument vertically, and move the fecond index until the direct and reflected horizons agree; and the divifion fhown by the index will be that required.

This adjuftment may be performed by meafuring the fun's diameter in contrary directions, or by making the reflected and direct images of a ftar or planet to coincide.

Ufe of the Circular Inftrument.

To obferve the diftance between the fun and moon.

I. The fun being to the right of the moon.

Set a proper coloured glafs before the central mirror, if the diftance between the objects is lefs than 35°; but if above that quantity, place a coloured glafs before the horizon mirror: make the mirrors parallel, the firft index being at *o*, and hold the inftrument fo that its plane may be directed to the objects, with its face downwards, or from the obferver: direct the fight through the telefcope to the moon: move the fecond index, according to the order of the divifions on the limb, till the neareft limbs of the fun and moon are almoft in contact: faften that index, and make the coincidence of the limbs perfect by the adjufting fcrew belonging thereto: then invert the inftrument, and move the central index towards the fecond by a quantity equal to twice the arch paffed over by that index: direct the plane of the inftrument to the objects: look directly to the moon, and the fun will be feen in the field of the telefcope: faften the central index, and make the contact of the fame two limbs exact by means of the adjufting fcrew: Then half the angle fhown by the central index will be the diftance between the neareft limbs of the fun and moon.

II. The fun being to the left of the moon.

Hold the inftrument with its face upwards, fo that its plane may pafs through both objects; direct the telefcope to the moon, and make its limb coincide with the neareft limb of the fun's reflected image, by moving the fecond index: now put the inftrument in an oppofite pofition; direct its plane to the objects, and the fight to the moon, the central index being previoufly moved towards the fecond by a quantity equal to twice the meafured diftance; and make the fame two limbs

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limbs that were before obſerved coincide exactly, by turning the adjuſting ſcrew of the firſt index: then half the angle ſhown by the firſt index will be the angular diſtance between the obſerved limbs of the ſun and moon.

To obſerve the Angular Diſtance between the Moon and a Fixed Star or Planet.

I. The ſtar being to the right of the moon.

In this caſe the ſtar is to be conſidered as the direct object; and the enlightened limb of the moon's reflected image is to be brought in contact with the ſtar or planet, both by a direct and inverted poſition of the inſtrument, exactly in the ſame manner as deſcribed in the laſt article. If the moon's image is very bright, the lighteſt tinged glaſs is to be uſed.

II. The ſtar being to the left of the moon.

Proceed in the ſame manner as directed for obſerving the diſtance between the ſun and moon, the ſun being to the right of the moon, uſing the lighteſt tinged glaſs, if neceſſary.

Sect. IV. *Of the Method of determining the Longitude from Obſervation.*

Prob. I. To convert degrees or parts of the equator into time.

Rule. Multiply the degrees and parts of a degree by 4, beginning at the loweſt denomination, and the product will be the correſponding time. Obſerving that minutes multiplied by 4 produce ſeconds of time, and degrees multiplied by 4 give minutes.

Example I. Let 26° 45′ be reduced to time.

26° 45′
4
1h 47′ 0″ = time required.

Example II. Reduce 83° 37′ to time.

83° 37′
4
Coreſponding time = 5 34 28

Prob. II. To convert time into degrees.

Rule. Multiply the given time by 10, to which add the half of the product. The ſum will be the correſponding degrees.

Example I. Let 3h 4′ 28″ be reduced to degrees.

3h 4 28″
10
30 44 40
Half = 15 22 20
Correſponding deg. = 46 7 0

Example II. Reduce 8h 42′ 36″ to degrees.

8h 42′ 36″
10
87 6 0
43 33 0
Anſwer 130 39 0

Prob. III. Given the time under any known meridian, to find the correſponding time at Greenwich.

Rule. Let the given time be reckoned from the preceding noon, to which the longitude of the place in time is to be applied by addition or ſubtraction, according as it is eaſt or weſt; and the ſum or difference will be the correſponding time at Greenwich.

Example I. What time at Greenwich anſwers to 6h 15′ at a ſhip in longitude 76° 45′W?

Time at ſhip - -	6h 15′
Longitude in time -	5 7 W.
Time at Greenwich, -	11 22

Example II. Required the time at Greenwich anſwering to 5h 46′ 39″ of May 1ſt, at Canton, whoſe longitude is 113° 2′ 15″E.?

Time at Canton, May 1ſt	5h 46′ 39″
Longitude in time -	7 32 9 E.
Time at Greenwich, April 30.	22 14 30

Prob. IV. To reduce the time at Greenwich to that under any given meridian.

Rule. Reckon the given time from the preceding noon, to which add the longitude in time of eaſt, but ſubtract it if weſt; and the ſum or remainder will be the correſponding time under the given meridian.

Example I. What is the expected time of the beginning of the lunar eclipſe of February 25. 1793, at a ſhip in longitude 109° 48′E?

Beg. of eclipſe at Greenwich *per* Naut. Alm.	9h 23′ 45″
Ship's longitude in time, -	7 19 12
Time of beginning of eclipſe at ſhip,	16 42 57

Example II. At what time may the immerſion of the firſt ſatellite of Jupiter be obſerved at Port St Julian, in longitude 68° 44′W. which, by the Nautical Almanac, happens at Greenwich 24th March 1792, at 17h 53′ 1″?

App. time of immerſion at Greenwich	17h 53′ 1″
Longitude of Port St Julian in time,	4 34 56 W.
App. time of immer at Port St Julian,	13 18 5

Prob. V. To find the equation of equal altitudes.

Rule. To the coſecant of half the interval of time in degrees add the tangent of the latitude, and to the cotangent of half the interval add the tangent of the declination. Now if the latitude and declination be of a contrary name, add the correſponding natural numbers; but if of the ſame name, ſubtract them. Then to the ar. co. log. of this ſum or difference add the proportional logarithm of one-fourth of the interval expreſſed in time, and the proportional logarithm of the daily variation of declination, the ſum will be the proportional logarithm of the equation of equal altitudes in minutes and ſeconds, which are to be eſteemed ſeconds and thirds.

Example. Let the latitude of the place of obſervation be 57° 9′N, the interval of time between the obſervations of the equal altitudes 5h 17′, the ſun's declination 17° 48′S, and the daily change of declination 16′ 19″½: Required the equation of equal altitudes?

Half the interval = 2h 38′½ = 39° 37′.

½ int. = 39° 37′	coſᵗ. 0.19542	cotang.			0.08209
Lat. 57 9	tan. 0.18997	dec. 17° 48′		ta.	9.50659
	0.38539	2.4288			
		3879			9.58868
Sum - -		2.8167	ar.co.lo.		9.5503

One

One-fourth interval	1h 19′ 15″	P.L. 0.3563
Daily variation of declination	16′ 19″½	P.L. 1.0424
Equation of equal altitudes	20″ 14‴	P.L. 0.9490

Prob. VI. To find the error of a watch by equal altitudes of the sun.

Rule. In the morning when the sun is more than two hours distant from the meridian, let a set of observations be taken, consisting, for the sake of greater accuracy, of at least three altitudes, which, together with the corresponding times *per* watch, are to be wrote regularly, the time of each observation being increased by 12 hours. In the afternoon, observe the instants when the sun comes to the same altitudes, and write down each opposite to its respective altitude.— Now half the sum of any two times answering to the same altitude will be the time of noon *per* watch uncorrect. Find the mean of all the times of noon thus deduced from each corresponding pair of observations, to which the equation of equal altitudes is to be applied by addition or subtraction according as the sun is receding from or approaching to the elevated pole, and the sum or difference will be the time *per* watch of apparent noon, the difference between which and noon will be the error of the watch for apparent time; and the watch will be fast or slow according as the time of noon thereby is more or less than twelve hours.

Example. January 29th, 1786, in lat. 57° 9 N′, the following equal altitudes of the sun were observed: Required the error of the watch?

Alt. = 8° 5′	Time 21h 35′ 8″ A.M.	2h 55′ 43″ P.M.
8 10	- 36 8	- 54 42
8 20	- 38 9	- 52 41.2
8 25	- 39 12.5	- 51 38
	37.5	4.2
	21 37 9.37	2 53 41.05
		21 37 9.37
Sum - - -		24 30 50.42
Time of noon *per* watch uncorrected		12 15 25.2.
Equation of equal altitudes		= 0 0 20.2.
Time *per* watch of apparent noon		12 15 5.
Watch fast - -		15 5.

The mean time of noon *per* watch is found by applying the equation of time with a contrary sine.

In practice it will be found convenient to put the index of the quadrant to a certain division, and to wait till either limb of the sun attains that altitude.

Prob. VII. Given the latitude of a place, the altitude and declination of the sun, to find the apparent time, and the error of the watch.

Rule. If the latitude and declination are of different names, let their sum be taken; otherwise, their difference. From the natural cosine of this sum or difference subtract the natural sine of the corrected altitude, and find the logarithm of the remainder; to which add the log. secants of the latitude and declination: the sum will be the log. rising of the horary distance of the object from the meridian, and hence the apparent time will be known.

Example I. September 15th 1792, in latitude 33° 56′ S, and longitude 18° 22′ E, the mean of the times per watch was 8^h 12′ 10″ A.M. and that of the altitudes of the sun's lower limb 24° 48′; height of the eye 24 feet. Required the error of the watch?

Obs. alt. Sun's lower limb	24° 48′	Sun's declin. at noon per Nautical Almanac	2° 40′.5 S
Semidiameter -	+ 16.0	Equation to 3^h 48′ A.M. -	+ 3.7
Dip - - -	− 4.7	- to 18° 22′ East -	+ 1.2
Correction - -	− 1.9	Reduced declination - -	2 45.4 S
True altitude Sun's centre	24 57.4		
Latitude -	33 56	- secant - -	0.08109
Declination - -	2 45.4	- secant - -	0.00050
Sum - -	36 41.4	nat. cosine 80188	
Sun's altitude - -	24 57.4	nat. sine 42193	
- - -		Difference 37995 - log. -	4.57973
Sun's meridian distance -	3^h 48′ 51″	- rising - -	4.66132
Apparent time - -	8 11 9		
Time per watch - -	8 12 10		
Watch fast - -	1 1		

Example. II. May 6th 1793, in latitude 56° 4′ N, and longitude 38° 30′ W, at 4^h 37′ 4″ P. M. per watch, the altitude of the sun's lower limb was 25° 6′.1, and height of the eye 18 feet. Required the error of the watch for apparent time?

Altitude sun's lower limb -	= 25° 6′.1	Sun's declin. per Nautical Almanac	16° 44′.3
Semidiameter -	+ 15.9	- Equation to 4^h 37′ P. M. -	+ 3.4
Dip - -	− 4.1	- - to 38° 30′ W -	+ 1.8
Correction - -	− 1.9	Reduced declination -	16 49.5
True alt. sun's centre. -	25 16.0		

Latitude

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Latitude	56 4.0 N	ſecant	0.25319
Declination	16 49.5 N	ſecant	0.01900
Difference	39 14.5	nat. coſine 77448	
Sun's altitude	25 16.0	nat. ſine 42683	
		Difference 34765	4.54114
Apparent time	4h 38′ 12″	riſing	4.81333
Time per watch	4 37 4		
Watch ſlow	1 8		

Prob. VIII. Given the latitude of a place, the altitude of a known fixed ſtar, and the ſun's right aſcenſion, to find the apparent time of obſervation and error of the watch.

Rule. Correct the obſerved altitude of the ſtar, and reduce its right aſcenſion and declination to the time of obſervation.

With the latitude of the place, the true altitude and declination of the ſtar, compute its horary diſtance from the meridian by laſt problem; which being added to or ſubtracted from its right aſcenſion according as it was obſerved in the weſtern or eaſtern hemiſphere, the ſum or remainder will be the right aſcenſion of the meridian.

From the right aſcenſion of the meridian ſubtract the ſun's right aſcenſion as given in the Nautical Almanac for the noon of the given day, and the remainder will be the approximate time of obſervation; from which ſubtract the proportional part of the daily variation of right aſcenſion anſwering thereto, and let the proportional part anſwering to the longitude be added or ſubtracted according as the longitude is eaſt or weſt, and the reſult will be the apparent time of obſervation; and hence the error of the watch will be known.

Example I. December 12th 1792, in latitude 37° 46′ N, and longitude 21° 15′ E, the altitude of Arcturus eaſt of the meridian was 34° 6′.4, the height of the eye 10 feet. Required the apparent time of obſervation?

Obſerved alt. of Arcturus	34° 6′.4		
Dip and refraction	— 4.4		
True altitude	34 2.0		
Latitude	37 46.0 N.	ſec. 0.10209	
Declination	20 14.4 N.	ſec. 0.02778	
Difference	17 31.6 N	coſ. 95358	
Altitude of Arcturus	34 2.0 N	ſine 55968	
		Difference 39390	4.59539
Arcturus's merid. diſt.	4h 8′ 10″	riſing	4.72526
right aſ.	14 6 13		
Right aſ. of merid.	9 58 3		
Sun's right aſ.	17 21 59		
Approximate time	16 36 4		
Eq. to approx. time	— 3 3		
Eq. to longitude	+ 16		
Ap. time of obſ.	16 33 17		

Example II. January 29th 1792, in latitude 53° 24′ N, and longitude 25° 18′ W, by account, at 14h 58′ 38″, the altitude of Procyon weſt of the meridian was 19° 58′; height of the eye 20 feet. Required the error of the watch?

Obſ. alt. of Procyon	19° 58′		
Dip and refraction	7		
True altitude	19 51		
Latitude	53 24	ſecant	0.22459
Declination	5 45	ſecant	0.00219
Difference	47 39	nat. coſ. 67366	
Altitude of Procyon	19 51	nat. ſine 33956	
		Difference 33410	4.52388
Procyon's merid. diſt.	4h 16′ 24″	riſing	4.75066
right aſ.	7 28 24		
Right aſ. of merid.	11 44 48		
Sun's right aſ.	20 47 22		
Approximate time	14 57 26		
Eq. to ap. time	—0 2 36		
Eq. to long.	—0 0 17		
Apparent time	14 54 33		
Time per watch	14 58 38		
Watch faſt	0 4 5		

Prob. IX. Given the altitude of the moon, the latitude of a place, and the apparent time at Greenwich, to find the apparent time at the place of obſervation.

Rule. Correct the altitude of the moon's limb by Problem V. p. 731, and reduce its right aſcenſion and declination, and the ſun's right aſcenſion to the Greenwich time of obſervation. Now with the latitude of the place, the declination and altitude of the moon, compute its meridian diſtance as before: Which being applied to its right aſcenſion by addition or ſubtraction, according as it is in the weſtern or eaſtern hemiſphere, will give the right aſcenſion of the meridian. Then the ſun's right aſcenſion ſubtracted from the right aſcenſion of the meridian, will give the apparent time of obſervation.

Example. March 3d 1792, in latitude 51° 38′ N, at 11h 29′ 7′ P.M. per watch, the altitude of the moon's lower limb was 37° 31′, the height of the eye being 10 feet, and the time at Greenwich 13h 43′. Required the error of the watch?

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Altitude of the moon's lower limb	= 37° 31′	Moon's right ascension at Green. time		7ʰ 22′ 54″
Semidiameter	+ 15	declination		17° 0 N
Dip	— 3	Sun's right ascension		23ʰ 2′ 0″
Correction	+ 42			
Corrected alt. of moon's centre	38 25			
Latitude	51 38 N	secant		0.20712
Declination	17 0 N	secant		0.01940
Difference	34 38	Nat. cosine	82281	
Moon's altitude	38 25	Nat. sine	62138	
		Difference	20143	4.30412
Moon's meridian distance	3° 14′ 36″	rising		4.53064
right ascension	7 22 54			
Right ascension of meridian	10 37 30			
Sun's right ascension	23 2 0			
Apparent time at ship	11 35 30			
Time per watch	11 29 7			
Watch slow	6 23			

Prob. X. Given the apparent distance between the moon and the sun or a fixed star, to find the true distance.

Rule. To the logarithmic difference answering to the moon's apparent altitude and horizontal parallax, add the logarithmic sines of half the sum, and half the difference of the apparent distance and difference of the apparent altitudes; half the sum will be the logarithmic cosine of an arch: now add the logarithm sines of the sum and difference of this arch, and half the difference of the true altitudes, and half the sum will be the logarithmic cosine of half the true distance.

Example. Let the apparent altitude of the moon's centre be 48° 22′, that of the sun's 27° 43′, the apparent central distance 81° 23′ 40″, and the moon's horizontal parallax 58′ 45″. Required the true distance?

Apparent altitude sun's centre	27° 43′ 0″	Apparent altitude moon's centre			48° 22′ 0″
Correction	— 1 40	Correction			+ 38 26
Sun's true altitude	27 41 20	Moon's true altitude			49 0 26
Sun's apparent altitude	27 43	Sun's true altitude			27 41 20
Moon's apparent altitude	48 22	Difference			21 19 6
Difference	20 39	Half			10 39 33
Apparent distance	81 23 40	Logarithmic difference			9.994638
Sum	102 2 40	Half	51° 1′ 20″	Sine	9.890639
Difference	60 44 40	Half	30 22 20	Sine	9.703820
Half difference true altitudes	10 39 33				19.589097
Arch	51 27 29			cosine	9.794548
Sum	62 7 2			sine	9.946417
Difference	40 47 56			sine	9.815183
					19.761600
	40 32 16			cosine	9.880800
	2				
True distance	81 4 32				

Prob. XI. To find the time at Greenwich answering to a given distance between the moon and the sun, or one of the stars, used in the Nautical Almanac.

Rule. If the given distance is found in the Nautical Almanac opposite to the given day of the month, or to that which immediately precedes or follows it, the time is found at the top of the page. But if this distance is not found exactly in the ephemeris, subtract the prop. log. of the difference between the distances which immediately precede and follow the given distance; from the prop. log. of the difference between the given and preceding distances, the remainder will be the prop. log. of the excess of the time corre-

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corresponding to the given distance, above that answering to the preceding distance: And hence the apparent time at Greenwich is known.

Example. September 21. 1792, the true distance between the centres of the sun and moon was 68° 13′ 8″. Required the apparent time at Greenwich?

Given distance	68° 13′ 8″		
Dist. at ix hours	67 53 27	Diff.=0° 19′ 41″	P. log. 9612
Dist at xii hours	69 30 6	Diff.=1 30 39	P. log. 2701
Excess - -		0 36 39	P. log. 6911
Preceding time -		9 0 0	
App. time at Greenwich		9 36 39	

Prob. XII. The latitude of a place and its longitude by account being given, together with the distance between, and the altitude of the moon and the sun, or one of the stars in the Nautical Almanac; to find the true longitude of the place of observation.

Rule. Reduce the estimate time of observation to the meridian of Greenwich by Problem III. and to this time, take from the Nautical Almanac, page vii. of the month, the moon's horizontal parallax and semidiameter. Increase the semidiameter by the augmentation answering to the moon's altitude.

Find the apparent and true altitudes of each object's centre, and the apparent central distance; with which compute the true distance by Problem X. and find the apparent time at Greenwich answering thereto by the last problem.

If the sun or star be at a proper distance from the meridian at the time of observation of the distance, compute the apparent time at the ship. If not, the error of the watch may be found from observations taken either before or after that of the distance; or the apparent time may be inferred from the moon's altitude taken with the distance, by Problem IX.

The difference between the apparent times of observation at the ship and Greenwich, will be the longitude of the ship in time; which is east or west according as the time at the ship is later or earlier than the Greenwich time.

Example I. March 17. 1792, in latitude 34° 53′ N, and longitude by account 27° W, about 9h A. M. the distance between the nearest limbs of the sun and moon was 68° 3′¼; the altitude of the sun's lower limb 33° 18′; that of the moon's upper limb 31° 3′; and the height of the eye 12 feet. Required the true longitude of the ship?

Time at ship - -	9h 0′ A. M.
Longitude in time -	1 48
Reduced time - -	10 48 A. M.
Altitude moon's upper limb	31 3 0
Aug. semidiameter -	— 16 19
Dip - -	— 3 18
Apparent altitude -	30 43 23
Correction - -	+ 49 26
Moon's true altitude -	31 32 49

Dist. sun and moon's nearest limbs -	68° 3′ 15″
Sun's semidiameter - -	+ 16 6
Moon's semidiameter - -	+ 16 10
Augmentation - -	+ 0 9
Apparent central distance -	68 35 40
Altitude sun's lower limb -	33 18
Sun's semidiameter - -	+ 16 6
Dip - - -	— 3 18
Sun's apparent altitude - -	33 30 48
Correction - -	—0 1 19
Sun's true altitude - -	33 29 29
Moon's true altitude - -	31 32 49
Difference - - -	1 56 40
Half - - -	0 58 20

Sun's apparent altitude -	33° 30′ 48″				
Moon's apparent altitude -	30 43 23				
Difference - -	2 47 25				
Apparent distance -	68 35 40	Logarithmic difference		-	9.996336
Sum - -	71 23 5	Half -	35° 41′ 32″½	Sine -	9.765991
Difference -	65 48 15	Half -	32 54 7½	Sine -	9.734964
					19.497291
Half difference true altitudes	0 58 20				
Arch - -	55 54 12			Cosine -	9.748645
Sum - -	56 52 32			Sine -	9.922977
Difference - -	54 55 52			Sine -	9.912998
					19.835975
Half true distance -	34 6 53			Cosine -	9.917987
	2				
True distance - -	68 13 46				

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True distance	68° 13′ 46″				
Distance at XXI hours	69 11 20	Difference	0° 57′ 34″	P. log.	4951
Distance at noon	67 32 38	Difference	1 38 42	P. log.	2610
Proportional part			1 45 0	Per. log.	2341
Preceding time			21 0 0		
Apparent time at Greenwich			22 45 0		

Latitude	34° 53′.0 N	Secant		0.08602
Declination	0 57.9 S	Secant		0.00006
Sum	35 50.9	Nat. cosine	81057	
Sun's altitude	33 29.5	Nat. sine	55181	
Difference			25876	4.41291
Time from noon	3h 7′ 13″	Rising		4.49899
Apparent time	20 52 47			
App. time at Green.	22 45 0			
Longitude in time	1 52 13 = 28° 3′¼ W.			

Example II. September 2. 1792, in latitude 13° 57′ N, and longitude by account 56° E, several observations of the moon and altair were taken; the mean of the times *per* watch was 1h 18′ 59″ A. M. that of the distance between altair and the moon's nearest limb 58° 45′ 26″; the mean of the altitude of the moon's lower limb 70° 33′; and that of altair 25° 27′.4; height of the eye 13 feet. Required the true longitude?

Time *per* watch	1h 18′ 59″ A. M.	Distance moon and altair			58° 45′ 26″
Longitude in time	3 44 0	Augmented semidiameter			+0 16 28
Reduced time	9 34 59	Apparent central distance			59 1 54
Altitude moon	70° 33′	Altitude of altair			25° 27′.4
Semidiameter and dip	—0 13	Dip			—0 3.4
Apparent alt. moon	70 20	Apparent altitude altair			25 24 0
Correction	+0 19 40	Refraction			—0 2 0
True altitude moon	70 39 40	True altitude altair			25 22 0
Moon's apparent alt.	70 20	Moon's true altitude			70 39 40
Altair's apparent alt.	25 24	Difference			45 17 40
Difference	44 56	Half			22 38 50
Apparent distance	59 1 54	Logarithmic difference			9.993101
Sum	103 57 54	Half	51° 58′ 57″	Sine	9.896428
Difference	14 5 54	Half	7 2 57	Sine	9.088919
Half diff. true alt.	22 38 50				18.978448
Arch	72 1 57			Cosine	9.489224
Sum	94 40 47			Sine	9.998548
Difference	49 23 7			Sine	9.880301
					19.878849
Half true distance	29 33 48½			Cosine	9.939424
	2				
True distance	59 7 37				
Distance at IX hours	58 51 17	Difference	0° 16′ 20″	P. log.	1.0422
— at XII hours	60 24 34	Difference	1 33 17	P. log.	0.2855
Proportional part			0 31 31	P. log.	0.7567
Preceding time			9 0 0		
Apparent time at Greenwich			9 31 31		

Latitude

Latitude	13° 57′ N		Secant	0.01300
Declination	8 19.8 N		Secant	0.00461
Difference	5 37.2	Nat. cosine	99519	
Altitude altair	25 22.	Nat. sine	42841	
Difference			56678	4.75341
Altair's meridian distance	4h 23′ 14″	Rising		4.77102
—— right ascension	19 40 40			
Right ascension meridian	0 3 54			
Sun's right ascension	10 46 17			
Apparent time at ship	13 17 37			
Apparent time at Greenwich	9 31 31			
Longitude in time	3 46 6 = 56° 31′½ East.			

For various other methods of determining the longitude of a place, the reader is referred to the article Longitude.

Chap. III. *Of the Variation of the Compass.*

The variation of the compass is the deviation of the points of the mariner's compass from the corresponding points of the horizon; and is denominated *east* or *west* variation, according as the north point of the compass is to the east or west of the true north point of the horizon.

A particular account of the variation, and of the several instruments used for determining it from observation, may be seen under the articles Azimuth, Compass, and Variation: and for the method of communicating magnetism to compass needles, see Magnetism.

Prob. I. Given the latitude of a place, and the sun's magnetic amplitude, to find the variation of the compass.

Rule. To the log. secant of the latitude, add the log. sine of the sun's declination, the sum will be the log. cosine of the true amplitude; to be reckoned from the north or south according as the declination is north or south.

The difference between the true and observed amplitudes, reckoned from the same point, and if of the same name, is the variation; but if of a different name, their sum is the variation.

If the observation be made in the eastern hemisphere, the variation will be east or west according as the observed amplitude is nearer to or more remote from the north than the true amplitude. The contrary rule holds good in observations taken in the western hemisphere.

Example I. May 15. 1794, in latitude 33° 10′ N, longitude 18° W, about 5h A. M. the sun was observed to rise E*b*N. Required the variation?

Sun's dec. May 15, at noon	18° 58′ N		
Equation to 7h from noon	—0 4		
—— to 18° W	+0 1		
Reduced declination	18 55	Sine	9.51080
Latitude	33 10	Secant	0.07723
True amplitude	N 67 13 E	Cosine	9.58803
Observed amplitude	N 78 45 E		
Variation	11 32		

Variation 11 32; which is *west*, because the observed amplitude is more distant from the north than the true amplitude; the observation being made in the eastern hemisphere.

Example II. December 20. 1793, in latitude 31° 38′ S, longitude 83° W, the sun was observed to set SW. Required the variation?

Latitude	31° 38′	Secant	0.06985
Declination	23 28	Sine	9.60012
True amplitude	S 62 7 W	Cosine	9.66997
Observed ampl.	S 45 0 W		
Variation	17 7		

Variation 17 7; which is *east*, as theo bserved amplitude is farther from the north than the true amplitude, the observation being made at sun-setting.

It may be remarked, that the sun's amplitude ought to be observed at the instant the altitude of its lower limb is equal to the sum of 15 minutes and the dip of the horizon. Thus, if an observer be elevated 18 feet above the surface of the sea, the amplitude should be taken at the instant the altitude of the sun's lower limb is 19 minutes.

Prob. II. Given the magnetic azimuth, the altitude and declination of the sun, together with the latitude of the place of observation; to find the variation of the compass.

Rule. Reduce the sun's declination to the time and place of observation, and compute the true altitude of the sun's centre.

Find the sum of the sun's polar distance and altitude and the latitude of the place, take the difference between the half of this sum and the polar distance.

To the log. secant of the altitude add the log. secant of the latitude, the log. cosine of the half sum, and the log. cosine of the difference; half the sum of these will be the log. sine of half the sun's true azimuth, to be reckoned from the south in north latitude, but from the north in south latitude.

The difference between the true and observed azimuths will be the variation as formerly.

Variation of the Compaſs.

Example I. November 18. 1793, in latitude 50° 22′ N, longitude 24°30′ W, about three quarters paſt eight A. M. the altitude of the ſun's lower limb was 8° 10′, and bearing *per* compaſs S. 23° 18′ E; height of the eye 20 feet. Required the variation of the compaſs?

Sun's declin. 18th Nov. at noon	19° 25′S.	Obſerved alt. ſun's lower limb	=8° 10
Equation to $3\frac{1}{4}^h$ from noon	— 2	Semidiameter	+ 16
———to 24° 30′ W	+ 1	Dip and refraction	— 10
Reduced declination	19 24	True altitude	8 16

Polar diſtance	109 24		
Altitude	8 16	Secant	0.00454
Latitude	50 22	Secant	0.19527
Sum	168 2		
Half	84 1	Coſine	9.01803
Difference	25 23	Coſine	9.95591
			19.17375
Half true azimuth	22 43	Sine	9.58687
	2		
True azimuth	S. 45 26 E.		
Obſerved azimuth	S. 23 18 E.		
Variation	22 8 W.		

Example II. January 3. 1794, in latitude 33° 52′ N, longitude 53° 15′ E, about half paſt three the altitude of the ſun's lower limb 41° 18′, and azimuth S. 50° 25′ W. the height of the eye being 20 feet Required the variation?

Sun's declination at noon	21° 24′ S.	Obſerved alt. ſun's lower limb.	=41° 18
Equation to time from noon	— 2	Sun's ſemidiameter	+ 16
———to longitude	+ 2	Dip and refraction	— 6
Reduced declination	21 24 S.	True altitude	41 28

Polar diſtance	111 24		
Altitude	41 28	Secant	0.12532
Latitude	33 52	Secant	0.08075
Sum	186 44		
Half	93 22	Coſine	8.76883
Difference	18 2	Coſine	9.97558
			18.95048
	17 23	Sine	9.47524
	2		
True azimuth	S. 34 46 W.		
Obſerved azimuth	S. 50 25 W.		
Variation	15 39 W.		

Chap. IV. *Of a Ship's Journal.*

A journal is a regular and exact regiſter of all the various tranſactions that happen aboard a ſhip whether at ſea or land, and more particularly that which concerns a ſhip's way, from whence her place at noon or any other time may be juſtly aſcertained.

That part of the account which is kept at ſea is called *ſea-work;* and the remarks taken down while the ſhip is in port are called *harbour-work.*

At ſea, the day begins at noon, and ends at the noon of the following day: the firſt 12 hours, or thoſe contained between noon and midnight, are denoted by P. M ſignifying *after mid-day;* and the other 12 hours, or thoſe from midnight to noon, are denoted by A. M. ſignifying *before mid-day.* A day's work marked Wedneſday March 6. began on Tueſday at noon, and ended on Wedneſday at noon. The days of the week are uſually repreſented by aſtronomical characters. Thus ☉ repreſents Sunday; ☽ Monday; ♂ Tueſday; ☿ Wedneſday; ♃ Thurſday; ♀ Friday; and ♄ Saturday.

When a ſhip is bound to a port ſo ſituated that ſhe will be out of ſight of land, the bearing and diſtance of the port muſt be found. This may be done by Mercator's or Middle-latitude Sailing; but the moſt expeditious method is by a chart. If iſlands, capes, or headlands intervene, it will be neceſſary to find the ſeveral courſe and diſtances between each ſucceſſively.

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cessively. The true course between the places must be reduced to the course *per* compass, by allowing the variation to the right or left of the true course, according as it is west or east.

At the time of leaving the land, the bearing of some known place is to be observed, and its distance is usually found by estimation. As perhaps the distance thus found will be liable to some error, particularly in hazy or foggy weather, or when that distance is considerable, it will therefore be proper to use the following method for this purpose.

Let the bearing be observed of the place from which the departure is to be taken; and the ship having run a certain distance on a direct course, the bearing of the same place is to be again observed. Now having one side of a plane triangle, namely the distance sailed and all the angles, the other distances may be found by Prob. I. of Oblique Sailing.

The method of finding the course and distance sailed in a given time is by the compass, the log line, and half-minute-glass. These have been already described. In the royal navy, and in ships in the service of the East India company, the log is hove once every hour; but in most other trading vessels only every two hours.

The several courses and distances sailed in the course of 24 hours, or between noon and noon, and whatever remarks that are thought worthy of notice, are set down with chalk on a board painted black, called the *log-board*, which is usually divided into six columns: the first column on the left hand contains the hours from noon to noon; the second and third the knots and parts of a knot sailed every hour, or every two hours, according as the log is marked; the fourth column contains the courses steered; the fifth the winds; and in the sixth the various remarks and phenomena are written. The log-board is transcribed every day at noon into the log-book, which is ruled and divided after the same manner.

The courses steered must be corrected by the variation of the compass and leeway. If the variation is west, it must be allowed to the left hand of the course steered; but if east, to the right hand in order to obtain the true course. The leeway is to be allowed to the right or left of the course steered according as the ship is on the larboard or starboard tack. The method of finding the variation, which should be determined daily if possible, is given in the preceding chapter; and the leeway may be understood from what follows.

When a ship is close hauled, that part of the wind which acts upon the hull and rigging, together with a considerable part of the force which is exerted on the sails, tends to drive her to the leeward. But since the bow of a ship exposes less surface to the water than her side, the resistance will be less in the first case than in the second; the velocity in the direction of her head will therefore in most cases be greater than the velocity in the direction of her side; and the ship's real course will be between the two directions. The angle formed between the line of her apparent course and the line she really describes through the water is called the *angle of leeway*, or simply the *leeway*.

There are many circumstances which prevent the laying down rules for the allowance of leeway. The construction of different vessels, their trim with regard to the nature and quantity of their cargo, the position and magnitude of the sail set, and the velocity of the ship, together with the swell of the sea, are all susceptible of great variation, and very much affect the leeway. The following rules are, however, usually given for this purpose.

1. When a ship is close hauled, has all her sails set, the water smooth, with a light breeze of wind, she is then supposed to make little or no leeway.

2. Allow one point when the top-gallant sails are handed.

3. Allow two points when under close reefed top-sails.

4. Allow two points and an half when one topsail is handed.

5. Allow three points and an half when both top-sails are handed.

6. Allow four points when the fore-course is handed.

7. Allow five points when under the mainsail only.

8. Allow six points when under balanced mizen.

9. Allow seven points when under bare poles.

These allowances may be of some use to work up the day's works of a journal which has been neglected; but a prudent navigator will never be guilty of this neglect. A very good method of estimating the leeway is to observe the bearing of the ship's wake as frequently as may be judged necessary; which may be conveniently enough done by drawing a small semicircle on the tafferel, with its diameter at right angles to the ship's length, and dividing its circumference into points and quarters. The angle contained between the semidiameter which points right aft and that which points in the direction of the wake is the leeway. But the best and most rational way of bringing the leeway into the day's log is to have a compass or semicircle on the tafferel, as before described, with a low crutch or swivel in its centre: after heaving the log, the line may be slipped into the crutch just before it is drawn in, and the angle it makes on the limb with the line drawn right aft will show the leeway very accurately; which as a necessary article, ought to be entered into a separate column against the hourly distance on the log-board.

In hard blowing weather, with a contrary wind and a high sea, it is impossible to gain any advantage by sailing. In such cases, therefore, the object is to avoid as much as possible being driven back. With this intention it is usual to lie to under no more sail than is sufficient to prevent the violent rolling which the vessel would otherwise acquire, to the endangering her masts, and straining her timbers, &c. When a ship is brought to, the tiller is put close over to the leeward, which brings her head round to the wind. The wind having then very little power on the sails, the ship loses her way through the water; which ceasing to act on the rudder, her head falls off from the wind, the sail which she has set fills, and gives her fresh way through the water; which acting on the rudder brings her head again to the wind. Thus the ship has a kind of vibratory motion, coming up to the wind and falling off from it again alternately. Now the middle point between those upon which she comes up and falls off is taken

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taken for her apparent courſe; and the leeway and variation is to be allowed from thence, to find the true courſe.

The ſetting and drift of currents, and the heave of the ſea, are to be marked down. Theſe are to be corrected by variation only.

The computation made from the ſeveral courſes corrected as above, and their correſponding diſtances, is called a *day's work;* and the ſhip's place, as deduced therefrom, is called her place by *account*, or *dead-reckoning*.

It is almoſt conſtantly found that the latitude by account does not agree with that by obſervation. From an attentive conſideration of the nature and form of the common log, that its place is alterable by the weight of the line, by currents, and other cauſes, and alſo the errors to which the courſe is liable, from the very often wrong poſition of the compaſs in the binnacle, the variation not being well aſcertained, an exact agreement of the latitudes cannot be expected.

When the difference of longitude is to be found by dead reckoning, if then the latitudes by account and obſervation diſagree, ſeveral writers on navigation have propoſed to apply a conjectural correction to the departure or difference of longitude. Thus, if the courſe be near the meridian, the error is wholly attributed to the diſtance, and the departure is to be increaſed or diminiſhed accordingly: if near the parallel, the courſe only is ſuppoſed to be erroneous; and if the courſe is towards the middle of the quadrant, the courſe and diſtance are both aſſumed wrong. This laſt correction will, according to different authors, place the ſhip upon oppoſite ſides of her meridian by account. As theſe corrections are, therefore, no better than gueſſing, they ſhould be abſolutely rejected.

If the latitudes are not found to agree, the navigator ought to examine his log-line and half-minute glaſs, and correct the diſtance accordingly. He is then to conſider if the variation and leeway have been properly aſcertained; if not, the courſes are to be again corrected, and no other alteration whatever is to be made on them. He is next to obſerve if the ſhip's place has been affected by a current or heave of the ſea, and to allow for them according to the beſt of his judgement. By applying theſe corrections, the latitudes will generally be found to agree tolerably well; and the longitude is not to receive any farther alteration.

It will be proper, however, for the navigator to determine the longitude of the ſhip from obſervation as often as poſſible; and the reckoning is to be carried forward in the uſual manner from the laſt good obſervation: yet it will perhaps be very ſatisfactory to keep a ſeparate account of the longitude by dead-reckoning.

Ship's Journal.

General Rules for working a Day's Work.

Correct the ſeveral courſes for variation and leeway; place them, and the correſponding diſtances, in a table prepared for that purpoſe. From whence, by Traverſe Sailing, find the difference of latitude and departure made good: hence the correſponding courſe and diſtance, and the ſhip's preſent latitude, will be known.

Find the middle latitude at the top or bottom of the Traverſe Table, and the diſtance, anſwering to the departure found in a latitude column, will be the difference of longitude: Or, the departure anſwering to the courſe made good, and the meridional difference of latitude in a latitude column, is the difference of longitude. The ſum, or difference of which, and the longitude left, according as they are of the ſame or of a contrary name, will be the ſhip's preſent longitude of the ſame name with the greater.

Compute the difference of latitude between the ſhip and the intended port, or any other place whoſe bearing and diſtance may be required: find alſo the meridional difference of latitude and the difference of longitude. Now the courſe anſwering the meridional difference of latitude found in a latitude column, and the difference of longitude in a departure column, will be the bearing of the place, and the diſtance anſwering to the difference of latitude will be the diſtance of the ſhip from the propoſed place. If theſe numbers exceed the limits of the Table, it will be neceſſary to take aliquot parts of them; and the diſtance is to be multiplied by the number by which the difference of latitude is divided.

It will ſometimes be neceſſary to keep an account of the meridian diſtance, eſpecially in the Baltic or Mediterranean trade, where charts are uſed in which the longitude is not marked. The meridian diſtance on the firſt day is that day's departure; and any other day it is equal to the ſum or difference of the preceding day's meridian diſtance and the day's departure, according as they are of the ſame or of a contrary denomination.

A JOURNAL

Ship's Journal.

A Journal of a Voyage from London to Funchal in Madeira, in his Majeſty's Ship the Reſoluton, A—— M—— Commander, *anno* 1793.

Days of Month.	Winds.	Remarks on board his Majeſty's ſhip Reſolution, 1793.
♄ Sept. 28.	SW	Strong gales and heavy rain. At 3 P. M. ſent down top-gallant yards; at 11 A. M. the pilot came on board.
☉ Sept. 29.	SW	Moderate and cloudy, with rain. At 10 A. M. caſt looſe from the ſheer hulk at Deptford; got up top-gallant yards, and made ſail down the river. At noon running through Blackwall reach.
☽ Sept. 30.	SW Variable	The firſt part moderate, the latter ſqually with rain. At half paſt one anchored at the Galleons, and moored ſhip with near a whole cable each way in 5 fathoms, a quarter of a mile off ſhore. At 3 A. M. ſtrong gales: got down top-gallant yards. A. M. the people employed working up junk. Bent the ſheet cable.
♂ Octob. 1.	SSW SW	Freſh gales and ſqually. P. M. received the remainder of the boatſwain's and carpenter's ſtores on board. The clerk of the cheque muſtered the ſhip's company.
☿ Octob. 2.	Variable N*b*E	Variable weather, with rain. At noon weighed and made ſail; at 5 anchored in Long-reach in 8 fathoms. Received the powder on board. At 6 A. M. weighed and got down the river. At 10 A. M. paſt the Nore; brought to and hoiſted in the boats; double reefed the topſails, and made ſail for the Downs. At noon running for the flats of Margate.
♃ Octob. 3.	N*b*E N	Firſt part ſtormy weather; latter moderate and clear. At 4 P. M. got through Margate Roads. At 5 run through the Downs; and at 6 anchored in Dover-road, in 10 fathoms muddy ground. Dover Caſtle bore north, and the ſouth Foreland NE*b*E$\frac{1}{2}$E off ſhore $1\frac{1}{4}$ miles. Diſcharged the pilot. Employed making points, &c. for the ſails. Scaled the guns.
♀ Octob. 4.	N NNE	Moderate and fair. Employed working up junk. Received from Deal a cutter of 17 feet, with materials. A. M. ſtrong gales and ſqually, with rain; got down top-gallant yards.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♄ Oct. 5. 1793.
1				NNE	Freſh gales with rain.
2					Hove ſhort.
3					Weighed and made ſail.
4	4				
5	6		WSW		
6	7				
7	7				
8	7				Shortened ſail.—Dungeneſs light NE*b*E.
9	6	4	W*b*N	NE	
10	6				
11	6				
12	6				Freſh breezes, and cloudy.
1	6				
2	6				
3	6				
4	6				Ditto weather.
5	6				
6	6				Got up top-gallant yards.
7	6				Set ſtudding ſails.
8	7				Ditto weather.
9	7	5			
10	7	5			
11	7	6			
12	8				St Alban's Head N$\frac{1}{4}$E.

A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ⊙ October 6. 1793.
1	8		W*b*N	NE	A fresh steady gale.
2	8				
3	8				
4	8				Do. weather.
5	8				Spoke the Ranger of London, from Carolina.
6	8				Took in studding sails.
7	8				
8	8				Do. weather.
9	8				
10	8				
11	8				Eddistone light N*b*W.
12	8				Do. weather.
1	8				Eddistone light NE.
2	7	5			
3	7	5			
4	7				Do. weather.
5	7		W*b*S		
6	7				Set lower studding sails.
7	7	4			
8	7	6			Fresh breeze and clear weather.
9	7	3			
10	7	5			
11	7	2			
12	7				Do. weather.

Course.	Dist.	D L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Lon. by Acc.	W. Lon. by Obs.	W. Var.		
S. 52° ½ W.	93	57	74	49° 11′	49° 9′	114 W.	6° 18′		2¼ pts.		

As there is no land in sight this day at noon, and from the course and distance run since the last bearing of the Eddistone light was taken, it is not to be supposed that any part of England will be seen, the departure is therefore taken from the Eddistone; and the distance of the ship from that place is found by resolving an oblique angled plane triangle, in which all the angles are given, and one side, namely, the distance run (16 miles) between the observations. Hence the distance from the Eddistone at the time the last bearing of the light was taken will be found equal to 18 miles; and as the bearing of the Eddistone from the ship at that time was NE, the ship's bearing from the Eddistone was SE. Now the variation 2¼ points W. being allowed to the left of SW. gives S*b*W¾W, the true course. The other courses are in like manner to be corrected, and inserted in the following table, together with their respective distances, beginning at 10 o'clock AM. the time when the last bearing of the Eddistone was taken. The difference of latitude, departure, course, and distance, made good, are to be found by Traverse Sailing.

Courses.	Dist.	Diff. of lat. N.	Diff. of lat. S.	Departure E.	Departure W.
S*b*W¾W	18		17.0		6.1
W*b*S¾S	22		5.3		21.3
SW¼W	58		34.6		46.6
S 52½° W.	93		56.9=57m.		74.0

Latitude of Eddistone -	50 8N.
Latitude by account -	49 11N.
Sum -	99 19
Middle latitude - -	49 40

Now to middle latitude as a course, and the departure 74m. in a latitude column, the difference of long. in a distance column is 114 = 1° 54′ W.

Longitude of Eddistone -	4 24 W
Longitude in by account -	6 18 W.

A Journal

Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☽ October 7. 1793.
1	6	5	WSW.	NE.	Fresh breezes.
2	6	5			Sounded 62 ; fine sand.
3	6				
4	5	3			Moderate and cloudy.
5	5				Unbent the cables, and coiled them.
6	5			N.	Took in studding sails.
7	5				
8	4	7			Do. weather.
9	4	5			
10	4	5			
11	4				
12	4				Do. weather.
1	4				
2	4				
3	4				
4	4				Light breeze.
5	3		SW*b*W.	NW.	
6	3				A sail S*b*E.
7	3				
8	3				Hazy weather.
9	3		SW.	Var.	
10	3				
11	3				
12	2				Do. weather.

Course.	Dist.	D.L.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. by ac.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 38° W.	99	78	62	47° 51′		93′W.	7° 51′		2¼ pts.	S 23°½W.	974 m.

The courses being corrected for variation, and the distances summed up, the work will be as under.

Courses.	Dist.	Diff. of latitude. N.	Diff. of latitude. S.	Departure. E.	Departure. W.
SW¾S.	77		57.0		51.7
SSW ¼ W.	12		10.3		6.2
S*b*W ¾ W.	11		10.4		3.7
S 38°W.	99		77.7		61.6
			1° 18′		

Yesterday's lat. by obser. = 49 9 N.
Latitude by account = 47 51 N.
Sum - 97 0
Middle latitude - 48 30

To middle latitude 48½°, and departure 61.6 in a latitude column, the correspondíng difference of longitude in a distance column is 93′ - = 1° 33 W.
Yesterday's longitude - 6 18 W.
Longitude in by account 7 51 W.

It is now necessary to find the bearing and distance of the intended port, namely, Funchal; but as that place is on the opposite side of the island with respect to the ship, it is therefore more proper to find the bearing of the east or west end of Madeira ; the east end is, however, preferable. But as the small island of Porto Sancto lies a little to the NE of the east end of Madeira, it therefore seems more eligible to find the bearing and distance of that island. To find the bearing and distance of Porto Sancto.

Latitude of ship	47° 51 N. Mer. parts 3278	Longitude of ship	7° 51 W.
Lat. of Porto Sancto	32 58 N. Mer. parts 2097	Lon. Porto Sancto	16 25 W.
Difference of latitude	14 53=893 M.D. lat. 1181	Difference of long.	8 34=514

The course answering to the meridional difference of latitude and difference of longitude is about 23°½, and the distance corresponding to the difference of latitude is 974 miles. Now as Porto Sancto lies to the southward and westward of the ship, the course is therefore S 23°½W ; and the variation, because W. being allowed to the right hand, gives SW ¼ W nearly, the bearing *per* compass ; and which is the course that ought to be steered.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♂ October 8. 1793.
1	2		SW	NW	Little wind and cloudy.
2	1			Variable.	
3					Tried the current and found none.
4			Ship's head to the SW.		Calm.
5					
6					
7			Ship's head from SWtoSSE.		Calm; a long swell from the SW.
8					
9					
10	1		WSW	S	
11	1				
12	2				Light airs and hazy.
1	2				
2	2				
3	2				
4	3				Moderate wind and cloudy.
5	3		W	S*b*W	
6	4				Set top-gallant sails.
7	5				
8	5				
9	5				
10	5		W ½N	SSW	
11	5				By double altitudes of the sun, the latitude
12	5				was found to be 47° 28′ N.

Course.	Dist.	D.L.	Dep.	N. Latit. by Acc.	N. Latit. by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 61° W.	51	25	45	47° 26′	47° 28′	67′ W.	8° 58′		2 points	S 21° W	932

The several courses corrected will be as under.

Courses.	Dist.	Diff. of latitude N	Diff. of latitude S	Departure.	Departure. W
SSW	3		2.8		1.1
SW	13		9.2		9.2
WSW	22		8.4		20.3
W*b*S½S	15		4.4		14.4
S 61° W	51		24.8	= 25	45.0

Yesterday's latitude	47 51
Latitude by account	47 26
Sum - -	77
Middle latitude -	47 39

To middle latitude $47\frac{2}{3}$°, and departure 45′ in a latitude column, the difference of longitude in a distance column is 67′ = 1° 7′ W

Yesterday's longitude	7 51 W
Longitude in by account	8 58 W

To find the bearing and distance of Porto Sancto.

Latitude of ship	47° 28 N	Mer. parts	3244	Longitude	8° 58′ W
Lat. of Porto Sancto	32 58 N	Mer. parts	2097	Longitude	16 25 W
Difference of latitude	14 30 = 870 M. D. lat.		1147	D. longitude	7 27=447′.

Hence the bearing of Porto Sancto is S21°W, and distance 932 miles. The course per compass is therefore SW nearly.

Ship's Journal.

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☿ October 9 1793.
1	5		W*b*N	SW*b*S	Squally with rain.
2	5				Handed top-gallant sails.
3	5	5			In 1st reef topsails.
4	5	4			Dark gloomy weather. Tacked ship.
5	5	6	SE*b*S		
6	5				In 2d reef topsails, and down top-gallant yards.
7	4				
8	4				Stormy weather; in fore and mizen topsails and 3d reef maintop sail. Handed the maintop sail, bent the main-stay sail, and brought to with it and the mizen; reefed the mainsail, at 10, wore and lay to under the mainsail, got down top-gallant masts; at 12 set the foresail, and balanced the mizen.
9	3				
10			up SE*b*S off ESE		
11	}		up WSW off WNW		
12	}				
1	3		W*b*N		
2	3	6			
3	3	5	WNW	SW	The sea stove in several half ports.
4	3	5			
5	4				The swell abates a little.
6	4		W*b*N	SW*b*S	
7	3	2			The swell abates fast.
8	3	4			Up top-gallant masts.
9	3	4	W	SSW	
10	4				Set the topsails.
11	5				
12	5				Clear weather; good observation.

Course.	Dist.	D.L	Dep.	N. latit. by		D.Long.	W. Long. by		W.Var.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing	Distance
W*b*N½N	43	12	41	47° 40′	47° 39′	61′	9° 59′		2 points.		

There is no leeway allowed until 2 o'clock P. M. when the top-gallant sails are taken in; from 2 to 3 one point is allowed; from 3 to 6, one and a half points are allowed; from 6 to 8, one and three-fourth points are allowed: from 8 to 9, three points; from 9 to 10, four and an half points; from 10 to 12, five points; from 12 to 10 A. M. three and an half points; and from thence to noon two points leeway are allowed. Now the several courses being corrected by variation and leeway will be as under; but as the corrected courses from 2 to 3 P. M. and from 10 to 12 A. M. are the same, namely, west; this, therefore, is inserted in the table, together with the sum of the distances, as a single course and distance. In like manner the courses from 12 to 2, and from 5 to 8 being the same, are inserted as a single course and distance.

Courses.	Dist.	Diff. of latit. N	Diff. of latit. S	Departure. E	Departure. W
W*b*S	10		2.0		9.8
W	15.5				15.5
W½N	5.4	0.5			5.4
E*b*S½S	10.6		3.1	10.1	
E*b*S½S	8		1.9	7.8	
E	3			3.0	
NE*b*E	1	0.6		0.8	
NW*b*W	2	1.1			1.7
NW*b*W½W	17.2	8.1			15.2
NW½W	11	7.0			8.5
W*b*N½N	7.4	2.1			7.1
		19.4	7.0	21.7	63.2
		7.0			21.7
W*b*N½N	43	1 4			41.5

Yest. latitude 47 28 N
Lat. by account 47 40 N
To middle latitude 47° 34′, and departure 41.5
the difference of longitude is 61′ = 1° 1′ W
Yesterday's longitude 8 58 W
Longitude in by account 9 59 W

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♃ October 10. 1793.
1	5	3	W	SSW	Fresh gales with rain.
2	5	7			
3	6				
4	6				Do. weather.
5	6				Out 3d reef topsails.
6	6				Lost a log and line.
7	5	6			
8	5	4			Do. weather.
9	5	5			
10	5	2			
11	5				
12	5				Do. weather.
1	5	5			
2	5				
3	5				
4	4				Moderate and cloudy, out all reefs.
5	4		WSW	S	
6	4				Sprung fore top-gallant yard, got up another.
7	4	3			
8	4	4	SW*b*W	SSE	Do. weather.
9	4	6			A sail NE.
10	5	3			Employed working up junk.
11	5	4		SE*b*S	A swell from the NW, which by estimation has
12	5				set ship 7 miles in the opposite direction.

Course.	Dist.	D.L.	Dep.	N. Latit. by		D. Long.	W. Long. by		W. Var.	Porto Sancto's	
				Acc.	Obs.		Acc.	Obs.		Bearing.	Distance.
S 74° W.	108	30	104	47° 9′		153′ W.	12° 32′		2 Points.	S 12° W.	870 m.

Two points leeway are allowed on the first course, one on the second; and as the ship is 7 points from the wind on the third course, there is no leeway allowed on it. The opposite point to NW, that from which the swell set, with the variation allowed upon it, is the last course in the Traverse Table.

Courses.	Dist.	Diff. of Latitude.		Departure.	
		N.	S.	E.	W.
W	86.2				86.2
SW*b*W	12.3		6.8		10.2
SW*b*S	24.7		20.5		13.7
ESE	7		2.7	6.5	
S 74 W	108		30.0	6.5	110.1

Yesterday's latitude 47 39 — 6.5

Latitude by account 47 9 — 103.6

Sum - 48

Middle latitude 47 24

To middle latitude 47 24, and departure 103.6, the difference of longitude is 153′ = 2° 33 W

Yesterday's longitude - 9 59 W

Longitude in - - 12 32 W

To find the bearing and distance of Porto Sancto.

Latitude of ship -	47° 9′	Mer. parts -	3216	Longitude -	12° 32′ W
Lat. Porto Sancto -	32 58	Mer. parts -	2097	Longitude -	16 25 W
Difference of latitude	14 11=851′	M. D. lat.	1119	D. longitude -	3 53=233.

Hence the bearing of Porto Sancto is S 12° W, and distance 870 miles; the course *per* compass is therefore about SW*b*W.

A Journal from England to Madeira.

Hours.	Kn.	Fa.	Courſes.	Winds.	Remarks, ♀ October 11. 1793.
1	4		SW*b*S	ESE	Moderate wind and fair weather.
2	3				Shortened ſail and ſet up the topmaſt rigging.
3	2				Do. weather.
4	3				Variation *per* amplitude 21° W.
5	4				
6	4	6			
7	4	4			A fine ſteady breeze.
8	4	5			By an obſervation of the moon's diſtance from
9	5			E	α Pegaſi, the ſhip's longitude at half paſt 8 was
10	5				12° 28′ W.
11	5				Clear weather.
12	5	2			
1	5	7			
2	6				
3	6			ENE	
4	6				Do. weather.
5	6	2			
6	6				
7	6	3			
8	6				Set ſtudding ſails, &c.
9	7				
10	7				One ſail in ſight.
11	8				
12	8				Do. weather, good obſervation.

Courſe.	Diſt.	D.L	Dep.	N. Latit. by		D. Long.	W. Long. by		W. Var. Obſerved.	Porto Sancto's	
				Acc.	Obſ.		Acc.	Obſ.		Bearing.	Diſtance.
S 12°45′W.	128	125	28	45 4′	44°59′	41′ W.	13°13′	12°59′	21°	S 12° W.	737 miles.

The obſerved variation 21° being allowed to the left of SW*b*S gives S 12° 45′ W, the corrected courſe, and the diſtance ſummed up is 127.9, or 128 miles. Hence the difference of latitude is 124.8, and the departure 28.2 The latitude by account is therefore 45° 4′ N, and the middle latitude 46° 6′, to which, and the departure 28.2 in a latitude column, the difference of longitude in a diſtance column is 41′ W; which being added to 12° 32′ W, the yeſterday's longitude, gives 13° 13′ W, the longitude in by account. But the longitude by obſervation was 12° 28 W at half paſt 8 P.M.; ſince that time the ſhip has run 96 miles; hence the departure in that interval is 21.2 m. Now half the difference of latitude 47 m. added to 44° 59′, the latitude by obſervation at noon, the ſum 45° 46′ is the middle latitude; with which and the departure 21.2, the difference of longitude is found to be 31′ W; which therefore added to 12° 28′, the longitude obſerved, the ſum is 12° 59′ W, the longitude by obſervation reduced to noon.

To find the bearing and diſtance of Porto Sancto.

Latitude ſhip	-	44° 59′ N. Mer. parts	-	3028	Longitude -	12° 59′ W
Lat. Porto Sancto		32 58 N. Mer. parts	-	2097	Longitude -	16 25 W
Difference of latitude		12 1=721	M. D. lat.	931	D. longitude -	3 26=206′

Hence the bearing of Porto Sancto is S 12° W, and diſtance 737 miles. The courſe to be ſteered is therefore S 33° W, or SW*b*S nearly.

 Ship's Journal.

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ♄ October 12. 1793.
1	8		SW*b*S.	E*b*N.	Fresh gales, and cloudy.
2	7	5			
3	8				
4	8	6			Do. Weather.
5	8	4			
6	8				Hauled down studding-sails.
7	7	5			
8	7	3			Do. Weather.
9	7	4			
10	7	2			
11	7	6			
12	7	5		ENE.	A steady gale and fine weather.
1	7				
2	7	5			
3	7				
4	7	3			Do. Weather.
5	7	2			
6	7				
7	7	4			Out studding-sails alow and aloft.
8	8				Variation *per* azimuth 20° 14′ W.
9	8				A sail in the SW quarter.
10	8				
11	7	6			Sailmaker altering a lower studding-sail.
12	8				Fine weather, and cloudy.

Course.	Dist.	D.L.	Dep.	N. Latit. by Acc.	N. Latit. by Obs	D.Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 13° 31′ W.	183	178	43	42° 1′		59′ W.	14° 12′	13° 58′	20° 14′	S 12° W.	555 m.

The course corrected by variation is S 13° 31′ W, and the distance run is 183 miles: hence the difference of latitude is 177.9, and the departure 42.8.

Yesterday's latitude by observation	-	44° 59′ N.	Mer. parts - - -	3028
Difference of latitude	-	2 58 S.		
Latitude in by account	-	42 1 N.	Mer. parts - -	2783
Meridional difference of latitude	-	-	- -	245

Now to course $13^\circ\frac{1}{2}$, and meridional difference of latitude 245 in a latitude column, the difference of longitude in a departure column is 59′ W: hence the yesterday's longitudes by account and observation, reduced to the noon of this day, will be 14° 12′ W and 13° 58′ respectively.

To find the bearing and distance of Porto Sancto.

Latitude ship -	42° 1′ N.	Mer. parts -	2783	Longitude -	13° 58′ W.
Lat. Porto Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W.
Difference of latitude	9 3 = 543	M. D. latitude	686	D. longitude -	2 27 = 147.

The meridional difference of latitude and difference of longitude will be found to agree nearest under 12°, the correct bearing of Porto Sancto; and the variation being allowed to the right hand of S 12° W, gives S. $32^\circ\frac{1}{4}$ W, the bearing *per* compass; and the distance answering to the difference of latitude 543, under 12 degrees, is 555 miles.

A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☉ October 13. 1793.
1	8		SW*b*S.	ENE.	A steady gale, and fine weather.
2	8	5			
3	8	6			At 34 minutes past three, the distance between the nearest limbs of the sun and moon, together with the altitude of each, were observed; from whence the ship's longitude at that time is 14° 1′ W.
4	8				
5	8				
6	8	4			
7	8				Hauled in the lower studding-sails.
8	7	5			At 9h 22′, by an observation of the moon's distance from α Pegasi, the longitude was 14° 20′W.
9	7				
10	7				
11	7				Fresh gales, and clear.
12	7				
1	7			ESE.	
2	8				
3	7				Do. weather.
4	7				
5	7				
6	7				
7	8				Variation *per* amplitude 19° 51′ W.
8	8				Do. *per* azimuth 19° 28′ W. Set studding-sails.
9	8	4			
10	8	2			Carried away a fore-top-mast studding-sail boom, got up another.
11	8				
12	7	4			Fresh gales. Took in studding-sails.

Course.	Dist.	D.L.	Dep.	N. latit. by Acc	N. latit. by Obs.	D.Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. by Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S*b*W¼W.	184	178	45	39° 3′		59′ W.	15° 11′	14° 52	1¾ pts.		

The mean of the variations is about 1¾ points W: hence the course corrected is S*b*W¼W; with which and the distance run 184 miles, the difference of latitude is 178.5, and the departure 44.7.

Yesterday's latitude - - - 42° 1′ N. Mer. parts - - 2783
Difference of latitude - - - 2 58 S.

Latitude in by account - - - 39 3 N. Mer. parts - - 2549

Meridional difference of latitude - - - - - 234

Now, to course 1¾ points, and meridional difference of latitude 234, the difference of longitude is about 59 m.; which, added to the yesterday's longitude by account 14° 12′ W, the sum 15° 11′ W is the longitude in by account at noon. The longitudes by observation are reduced to noon as follow:

The distance run between noon and 3h 34′ P. M. is 29 miles; to which, and the course 1¼ points, the difference of latitude is - - 28′
Yesterday's latitude at noon - - 42 1 N.

Latitude at time of observation - - 41 33 N. Mer. parts - - 2746
Latitude at noon - - 39 3 N. Mer. parts - - 2549

Meridional difference of latitude - - - - - 197

Then, to course 1¼ points, and meridional difference of latitude 197 in a latitude column, the difference of longitude in a departure column is 49′ W; which added to 14° 1′ W, the longitude by observation, the sum 14° 50′ W is the longitude reduced to noon.

Again, the distance run between the preceding noon and 9h 22′ P. M. is 75 miles: hence the corresponding difference of latitude is 72.8, or 73 miles; the ship's latitude at that time is therefore 40° 48′ N.

Latitude at time of observation - - 40° 48′ N. Mer. parts - 2686
Latitude at noon - - - 39 3 N. Mer. parts - 2549

Meridional difference of latitude - - - - 137

Now with the corrected course, and meridional difference of latitude, the difference of longitude is 34′ W; which added to 14° 20′ W, the sum is 14° 54′ W, the reduced longitude. The mean of which and the former reduced longitude is 14° 52′ W, the correct longitude.

A Journal

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☽ October 14. 1793.
1	8		SW*b*S	E*b*S	Fresh gales and hazy, single reefed topsails.
2	7	5			
3	7	5			Got down top-gallant yards.
4	7				Do. weather, and a confused swell running.
5	7	4	SSW		
6	7	1			
7	7				
8	6	5			More moderate.
9	6			Variable.	
10	5				
11	5				
12	4				Do. with lightning all round the compass.
1	3				
2	3				
3	3	5	SW*b*S	SE*b*S	
4	4				Squally, with rain.
5	5				
6	4				
7	2	5			
8	2		SW	SSE	Moderate weather; out reefs, and up top-gallant-yards.
9	3				
10	3	5			
11	4	5	WSW	S	At 11h 10′ A.M. the latitude from double altitudes of the sun was 37° 10′. Clear weather.
12	5				

Course.	Dif.	DL.	Dep.	N. Latitude by Acc.	N. Latitude by Obs.	D. Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 16°W.	116	111	32	37° 12′	37° 8′	41′W.	15° 52′	15° 33′	$1\frac{1}{4}$ pts.	S10°W.	254 m.

As the ship is close hauled from 2 o'clock AM. $1\frac{1}{4}$ points leeway are allowed upon that course, and 1 point on the two following courses.

Courses.	Dist.	Diff. of latitude. N.	Diff. of latitude. S.	Departure. E.	Departure. W.
S*b*W$\frac{1}{4}$W	30		29.1		7.3
S$\frac{1}{4}$W	54		53.9		2.7
SSW$\frac{1}{2}$W	19		16.8		9.0
SW$\frac{1}{4}$S	8.5		6.8		5.1
SW*b*W$\frac{1}{4}$W.	9.5		4.9		8.1
S16°W.	116		111.5 = 1° 51		32.2

Yesterday's latitude - 39 3
Latitude in by account 37 12 } M. lat. 38° 7

To middle latitude 38°, and departure 32.2 in a latitude column, the difference of longitude in a distance column is 41′.

Yesterday's lon. by account	15° 11′W. by	ob. 14° 52′W.
Difference of longitude	41 W.	41 W.
Longitude in	15 22	15 33 W.

The latitude by observation at 11h 10′ A.M. is 37° 10′, and from that time till noon the ship has run about 4 miles. Hence the correspondiug difference of latitude is 2 miles, which subtracted from the latitude observed, gives 37° 8′, the latitude reduced to noon.

To find the bearing and distance of Porto Sancto.

Latitude of ship	37° 8′N.	Mer. parts 2403	Longitude 15° 33′W.
Latitude Porto Sancto	32 58 N.	Mer. parts 2097	Longitude 16 25 W.
Difference of latitude	4 10 = 250	M. D. Lat. 306	Diff. long. 52

Hence the bearing of Porto Sancto is S. 10°W, or SSW $\frac{1}{4}$ W nearly, *per* compass, and the distance is 254 miles.

A Journal from England towards Madeira.

Hours	Kn.	Fa.	Courses.	Winds.	Remarks, ♂ October 15. 1793.
1	4		WbS	SbW	Moderate and clear weather.
2	4				
3	3	6			Employed working points and rope-bands.
4	3				Ditto weather.
5	3	4			
6	3		WbN	SWbS	
7	3				
8	3	2			Fine clear weather.
9	4				
10	4				
11	3	5			
12	3	3		Variable.	Ditto weather.
1	3				
2	4		W		
3	3				
4	2		WNW		
5	2	4	NWbW	SWbW	
6	3				
7	3				Variation per mean of several azimuths 18° 0′ W.
8	3	6			Ditto weather. Tacked ship.
9	4		SbE		
10	5				Sail-makers making wind-sails.
11	5	4			
12	5	6			A fine steady breeze. Cloudy.

Course.	Dist.	D.L.	Dep.	N. Lat. by Acc.	N. Lat. by Obs.	D. Long.	W. Long. by Account.	W. Long. by Observ.	W. Var. by Obs.	Porto Santo's Bearing.	Porto Santo's Distance.
S 68° W	56	21	52	36° 47′		65′ W	16° 57′	16° 38′	18°	S¼E	229

Half a point of leeway is allowed on each course; but as the variation is expressed in degrees, it will be more convenient and accurate to reduce the several courses into one, leeway only being allowed upon them. The course thus found is then to be corrected for variation, with which and the distance made good the difference of latitude and departure are to be found.

Courses.	Dist.	Diff. of Latitude. N	Diff. of Latitude. S	Departure. E	Departure. W
W½S	18		1.8		17.9
WbN½N	27	7.8			25.8
W½N	7	0.7			7.0
NWbW½W	2	0.9			1.8
NW½W	12	7.6			9.3
SbE½E	20		19.1	5.8	
		17.0	20.9	5.8	61.8
			17.0		5.8
S 86° W.	56		3.9		56.0
Var. 18 W.					

Tr. cour. S 68 W. to which and the distance 56 m. the difference of latitude is 21 m. and the departure 51.9 m. Hence the latitude in at noon is 36° 47′ W, and middle latitude 36° 58′, to which and the departure 51.9 in a latitude column, the difference of longitude in a distance column is 65° W.

	By acc.		By obs.
Yesterday's long. by acc.	15° 52′ W.	By obs.	15° 33′ W.
Difference of longitude	1 5 W.		1 5 W.
Longitude in	16 57		16 38 W.

To find the bearing and distance of Porto Sancto.

Latitude ship	36° 47′ N	Mer pts	2376	Longitude	16° 38′ W.
Lat. of Porto Sancto	32 58 N	Mer. pts.	2097	Longitude	16 25 W.
Diff. of latitude	3 49=229	M.D.Lat.	279	D. Longitude	0 13

Hence the course is S¼E, distance 229 miles; and the course *per* compass is SbW½W nearly

A Journal from England towards Madeira.

Hours.	Kn.	Fa.	Courses.	Winds.	Remarks, ☿ October 16. 1793.
1	6		SbE.	SWbW.	Fresh gales.
2	6	4			
3	7		S.	W.	
4	7				Do. and cloudy.
5	7				
6	7	4			
7	7	6			A steady fresh gale.
8	7				
9	8		SbW.	NW.	
10	8				
11	8				
12	8				Do. weather.
1	8				
2	8				
3	8				
4	9				Do. Weather.
5	9		SbW½W.		
6	9			N.	Variation *per* amplitude 1½ points W.
7	9				
8	8	5			People employed occasionally.
9	9				
10	9			NEbE.	
11	7				
12	8				Do. weather. Observed sun's meridian altitude.

Course.	Dist.	D.L.	Dep.	N. Latit. by Acc.	N. Latit. by Obs.	D.Long.	W. Long. by Acc.	W. Long. by Obs.	W. Var. Obs.	Porto Sancto's Bearing.	Porto Sancto's Distance.
S 8° E	186	1 5	26	33° 42′	33° 46′	31′ E.	16° 26′	16° 7′	1½ pts.	S 17° W.	50 miles.

Half a point of leeway is allowed on the first course; which, and the others, are corrected for variation as usual.

Courses.	Dist.	Diff. of latit. N.	Diff. of latit. S.	Departure. E.	Departure. W.
SEbS.	12.4		10.3	6.9	
SbE½E.	43.		41.2	12.5	
S½E.	65		64.7	6.4	
S.	68.5		68.5		
S8°E.	186		184.7	25.8	
			3° 5′		

Yesterday's latitude		36 47 N.	
Latitude by account	-	33 42 N.	
Sum	- -	70 29	
Middle latitude	-	35 15	

To middle latitude and the departure, the difference of longitude in a distance column is 31′ E

Yesterday's lon. by acc.	16 57′ W.	by obs.	16° 38′ W.
Difference of long.	0 31 E.	-	31 E.
Longitude in -	16 26 W.	-	16 7 W.

To find the bearing and distance of Porto Sancto.

Latitude ship -	33° 46′ N.	Mer. parts -	2155	Longitude -	16° 7′ W.
Lat. Porto Sancto	32 58 N.	Mer. parts -	2097	Longitude -	16 25 W.
Difference of latitude	48	Mer. diff. lat.	58	Diff. long. -	18

Hence the bearing of Porto Sancto is S 17° W, distance 50 miles.

A Journal

A Journal from London towards Madeira.

Hours	Kn.	Fa.	Courſes.	Winds.	Remarks, ♃ October 17. 1793.
1	5		SSW.	NE*b*E.	Moderate wind and clear.
2	5				Saw the iſland of Porto Sancto, SW*b*S.
3	5		S.		Hauled up to round the eaſt end of Porto Sancto.
4	5				Bent the cables.
5	5				
6	6				
7	6				
8	7				Squally weather.
9	8		SW*b*S.		Porto Sancto W*b*S.
10	7				
11	7		SW*b*W		
12	6				Ditto with rain. Porto Sancto NE.
1	6		SW.		The Deſerters SW*b*S.
2	5				
3	6				
4	7				The Deſerters WSW. 3 or 4 leagues.
5	6				
6			Various.		Hauled up round the eaſt end of the Deſerters.
7					
8			NNW.		Violent ſqualls; clewed upall at times.
9			NW*b*N.		Running into Funchal Roads.
10					
11					Anchored in Funchal Road, with the beſt bower in 30
12					fathom black ſand and mud. Brazen head E*b*S$\frac{1}{4}$S, Loo Rock NW, the Great Church NNE, and the ſouthermoſt Deſerter SE$\frac{1}{2}$S; off ſhore two-thirds of a mile. Saluted the fort with 13 guns; returned by ditto. Found here his majeſty's ſhip Venus, and 7 Engliſh merchant ſhips.

This journal is performed by inſpection agreeable to the precepts given. Other methods might have been uſed for the ſame purpoſe; for which the two inſtruments already deſcribed and explained ſeem well adapted. We cannot, however, omit recommending the ſliding gunter, which will be found very expeditious, not only in performing a day's work, but alſo in reſolving moſt other nautical problems. See *Sliding-Gunter*.

It will be found very ſatisfactory to lay down the ſhip's place on a chart at the noon of each day, and her ſituation with reſpect to the place bound to, and the neareſt land will be obvious. The bearing and diſtance of the intended or any other port, and other requiſites, may be eaſily found by the chart as already explained; and indeed, every days work may be performed on the chart; and thus the uſe of tables ſuperſeded.

EXPLANATION OF THE TABLES.

TABLE I. *To reduce points of the compaſs to degrees, and converſely.*

THE two firſt and two laſt columns of this table contain the ſeveral points and quarter-points of the compaſs; the third column contains the correſponding number of points and quarters; and the fourth, the degrees &c. anſwering thereto. The manner of uſing this table is obvious.

TABLE II. *The miles and parts of a mile in a degree of longitude at every degree of latitude.*

THE firſt column contains degrees of latitude, and the ſecond the correſponding miles in a degree of longitude; the other columns are a continuation of the firſt and ſecond. If the given latitude conſiſts of degrees and minutes, a proportional part of the difference between the miles anſwering to the given and following degrees of latitude is to be ſubtracted from the miles anſwering to the given degree.

EXAMPLE. Required the number of miles in a degree of longitude in latitude 57° 9′?

The difference between the miles anſwering to the latitudes of 57° and 58° is 0.89.

Then as 60′ : 9′ : : 0.89 : 0.13
Miles anſwering to 57° 32.68

Miles anſwering to 57° 9′ 32.55

This table may be uſed in Parallel and Middle Latitude Sailing.

TABLE III. *Of the Sun's Semidiameter.*

This table contains the angle ſubtended by the ſun's ſemidiameter at the earth, for every ſixth day of the year. The months and days are contained in the firſt column, and the ſemidiameter expreſſed in minutes and ſeconds in the ſecond column. It is uſeful in correct-

 ing

Explanation of the Tables.

ing altitudes of the sun's limb, and distances between the sun's limb and the moon.

Table IV. *Of the Refraction in Altitude.*

The refraction is necessary for correcting altitudes and distances observed at sea; it is always to be subtracted from the observed altitude, or added to the zenith distance. This table is adapted to a mean state of the atmosphere in Britain, namely, to 29.6 inches of the barometer, and 50° of the thermometer. If the height of the mercury in these instruments be different from the mean, a correction is necessary to reduce the tabular to the true refraction. See Refraction.

Tables V. VI. *Of the Dip of the Horizon.*

The first of these tables contains the dip answering to a free or unobstructed horizon; and the numbers therein, as well as in the other table, are to be subtracted from the observed altitude, when the fore-observation is used; but added, in the back-observation.

When the sun is over the land, and the ship nearer it than the visible horizon when unconfined: in this case, the sun's limb is to be brought in contact with the line of separation of the sea and land; the distance of that place from the ship is to be found by estimation or otherwise; and the dip answering thereto, and the height of the eye, is to be taken from Table VI.

Table VII. *Of the Correction to be applied to the time of high water at full and change of the moon, to find the time of high water on any other day of the moon.*

The use of this table is fully explained at Section II. Chap. I. Book I. of this article.

Tables VIII. IX. X. *Of the Sun's declination*, &c.

The first of these tables contains the sun's declination, expressed in degrees, minutes, and tenths of a minute, for four successive years, namely, 1793, 1794, 1795, and 1796: and by means of Table X. may easily be reduced to a future period; observing that, after the 28th of February 1800, the declination answering to the day preceding that given is to be taken.

Example I. Required the sun's declination May 1. 1799?

May 1. 1799 is four years after the same day in 1795.

Sun's declination May 1. 1795	15° 9'.1 N
Equation from Table X.	+0 0.6
Sun's declination May 1. 1799	15 9.7 N

Example II. Required the sun's declination August 20. 1805?

The given year is 12 years after 1793, and the time is after the end of February 1800.

Now, Sun's dec. August 19. 1793	12° 34'.6
Equation from Table X. to 12 years	—0 1.9
Sun's declination August 20. 1805	12 32.7

The declination in Table VIII. is adapted to the meridian of Greenwich, and Table IX. is intended to reduce it to any other meridian, and to any given time of the day under that meridian. The titles at the top and bottom of this table direct when the reduction is to be added or subtracted.

Table XI. *Of the Right Ascensions and Declinations of Fixed Stars.*

This table contains the right ascensions and declinations of 60 principal fixed stars, adapted to the beginning of the year 1793. Columns fourth and sixth contain the annual variation arising from the precession of the equinoxes, and the proper motion of the stars; which serves to reduce the place of a star to a period a few years after the epoch of the table with sufficient accuracy. When the place of a star is wanted, after the beginning of 1793, the variation in right ascension is additive; and that in declination is to be applied according to its sign. The contrary rule is to be used when the given time is before 1793.

Example. Required the right ascension and declination of Bellatrix, May 1. 1798?

Right ascension January 1. 1793	=	5h 14' 3"
Variation = $3''.21 \times 5\frac{1}{3}$ y.	=	+0 0 17
Right ascension, May 1. 1798	=	5 14 20
Declination		6° 8' 53" N
Variation = $4'' \times 5\frac{1}{3}$ y.	=	+0 0 21
Declination May 1. 1798	=	6 9 14 N

The various other tables necessary in the practice of navigation are to be found in most treatises on that subject. Those used in this article are in Mackay's Treatises on the Longitude and Navigation.

Table

As the Author of this Article lives at a distance, several Errata *have escaped the Press. They are as follow.*

Page	col.	lines
683.	1.	20. and 22. from bottom. For *Markelyne's*, read *Maskelyne's*.
685.	2.	10. from bottom. For 55' N. read 55' S.
686.	1.	25. For N. read S.; and in line 28. for 13° 44' N. read 18° 6' S.
687.	1.	7. from bottom. After *measures*, insert 177.
ib.	2.	23. from bottom. After *about*, insert 280.
689.	2.	16. from bottom. After *one*, insert *fourth*; and in line 21. for *where*, read *whose*.
690.	1.	29. For *a*, read *the*.
691.	1.	5. from bottom. After *to*, insert 43° 53'; and in line 29. for *abstracted*, read *subtracted*, and for 8. read 4.
692.	2	2. from bottom. For 73 N, read N 73°.
693.	1.	15. After *be*, insert 281; and in line 17. after *is*, insert 9° 11' W.
695.	1.	21. from bottom. For *mark*, read *make*.
698.	2.	19. For *on*, read *in*; and in line 20. after 61 dele (°)

TABLE I. *To reduce Points of the Compass to Degrees, and conversely.*

North-east Quadrant.	South-east Quadrant.	Points.		D.	M.	S.	South-west Quadrant.	North-west Quadrant.
North.	South.	0	0	0	0	0	South.	North.
N¼E	S¼E	0	¼	2	48	45	S¼W	N¼W
N½E	S½E	0	½	5	37	30	S½W	N½W
N¾E	S¾E	0	¾	8	26	15	S¾W	N¾W
N*b*E	S*b*E	1	0	11	15	0	S*b*W	N*b*W
N*b*E¼E	S*b*E¼E	1	¼	14	3	45	S*b*W¼W	N*b*W¼W
N*b*E½E	S*b*E½E	1	½	16	52	30	S*b*W½W	N*b*W½W
N*b*E¾E	S*b*E¾E	1	¾	19	41	15	S*b*W¾W	N*b*W¾W
NNE	SSE	2	0	22	30	0	SSW	NNW
NNE¼E	SSE¼E	2	¼	25	18	45	SSW¼W	NNW¼W
NNE½E	SSE½E	2	½	28	7	30	SSW½W	NNW½W
NNE¾E	SSE¾E	2	¾	30	56	15	SSW¾W	NNW¾W
NE*b*N	SE*b*S	3	0	33	45	0	SW*b*S	NW*b*N
NE¾N	SE¾S	3	¼	36	33	45	SW¾S	NW¾N
NE½N	SE½S	3	½	39	22	30	SW½S	NW½N
NE¼N	SE¼S	3	¾	42	11	15	SW¼S	NW¼N
NE	SE	4	0	45	0	0	SW	NW
NE¼E	SE¼E	4	¼	47	48	45	SW¼W	NW¼W
NE½E	SE½E	4	½	50	37	30	SW½W	NW½W
NE¾E	SE¾E	4	¾	53	26	15	SW¾W	NW¾W
NE*b*E	SE*b*E	5	0	56	15	0	SW*b*W	NW*b*W
NE*b*E¼E	SE*b*E¼E	5	¼	59	3	45	SW*b*W¼W	NW*b*W¼W
NE*b*E½E	SE*b*E½E	5	½	61	52	30	SW*b*W½W	NW*b*W½W
NE*b*E¾E	SE*b*E¾E	5	¾	64	41	15	SW*b*W¾W	NW*b*W¾W
ENE	ESE	6	0	67	30	0	WSW	WNW
E*b*N¾N	E*b*S¾S	6	¼	70	18	45	W*b*S¾S	W*b*N¾N
E*b*N½N	E*b*S½S	6	½	73	7	30	W*b*S½S	W*b*N½N
E*b*N¼N	E*b*S¼S	6	¾	75	56	15	W*b*S¼S	W*b*N¼N
E*b*N	E*b*S	7	0	78	45	0	W*b*S	W*b*N
E¾N	E¾S	7	¼	81	33	45	W¾S	W¾N
E½N	E½S	7	½	84	22	30	W½S	W½N
E¼N	E¼S	7	¾	87	11	15	W¼S	W¼N
East.	East.	8	0	90	0	0	West.	West.

TABLE II. *The Miles and Parts of a Mile in a Degree of Longitude at every Degree of Latitude.*

D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.	D.L.	Miles.
1	59.99	16	57.67	31	51.43	46	41.68	61	29.09	76	14.51
2	59.97	17	57.36	32	50.88	47	40.92	62	28.17	77	13.50
3	59.92	18	57.06	33	50.32	48	40.15	63	27.24	78	12.48
4	59.86	19	56.73	34	49.74	49	39.36	64	26.30	79	11.45
5	59.77	20	56.38	35	49.15	50	38.57	65	25.36	80	10.42
6	59.67	21	56.01	36	48.54	51	37.76	66	24.41	81	9.38
7	59.56	22	55.63	37	47.92	52	36.94	67	23.45	82	8.35
8	59.44	23	55.23	38	47.28	53	36.11	68	22.48	83	7.32
9	59.26	24	54.81	39	46.62	54	35.26	69	21.50	84	6.28
10	59.08	25	54.38	40	45.95	55	34.41	70	20.52	85	5.23
11	58.89	26	53.93	41	45.28	56	33.55	71	19.54	86	4.18
12	58.68	27	53.46	42	44.95	57	32.68	72	18.54	87	3.14
13	58.46	28	52.97	43	43.88	58	31.79	73	17.54	88	2.09
14	58.22	29	52.47	44	43.16	59	30.90	74	16.53	89	1.05
15	57.95	30	51.96	45	42.43	60	30.00	75	15.52	90	0.00

TABLE III. *The Sun's Semidia*

Mon.	Day	Sun's Semidia.n.	
January.	1	16′	19″
	7	16	19
	13	16	19
	19	16	18
	25	16	17
February.	1	16	16
	7	16	15
	13	16	14
	19	16	13
	25	16	12
March.	1	16	10
	7	16	9
	13	16	7
	19	16	6
	25	16	4
April.	1	16	2
	7	16	1
	13	15	59
	19	15	57
	25	15	56
May.	1	15	54
	7	15	53
	13	15	52
	19	15	51
	25	15	50
June.	1	15	49
	7	15	48
	13	15	47
	19	15	47
	25	15	47
July.	1	15	47
	7	15	47
	13	15	47
	19	15	48
	25	15	48
August.	1	15	49
	7	15	50
	13	15	51
	19	15	52
	25	15	53
September.	1	15	55
	7	15	56
	13	15	58
	19	15	59
	25	16	1
October.	1	16	3
	7	16	4
	13	16	6
	19	16	8
	25	16	9
November.	1	16	11
	7	16	13
	13	16	14
	19	16	15
	25	16	16
December.	1	16	17
	7	16	18
	13	16	18
	19	16	19
	25	16	19

Table IV.
Refraction in Altitude.

App. Alt.	Refrac.	App. Alt.	Refrac.	App Alt.	Refrac.
D. M.	M. S.	D. M.	M S	D.	M. S.
0 0	33 0	6 30	7 51	30	1 38
0 5	32 10	6 40	7 40	31	1 35
0 10	31 22	6 50	7 30	32	1 31
0 15	30 35	7 0	7 20	33	1 28
0 20	29 50	7 10	7 11	34	1 24
0 25	29 6	7 20	7 2	35	1 21
0 30	28 22	7 30	6 53	36	1 18
0 35	27 41	7 40	6 45	37	1 16
0 40	27 0	7 50	6 37	38	1 13
0 45	26 20	8 0	6 29	39	1 10
0 50	25 42	8 10	6 22	40	1 8
0 55	25 5	8 20	6 15	41	1 5
1 0	24 49	8 30	6 8	42	1 3
1 5	23 54	8 40	6 1	43	1 1
1 10	23 20	8 50	5 55	44	0 59
1 15	22 47	9 0	5 48	45	0 57
1 20	22 15	9 10	5 42	46	0 55
1 25	21 44	9 20	5 36	47	0 53
1 30	21 15	9 30	5 31	48	0 51
1 35	20 46	9 40	5 25	49	0 49
1 40	20 18	9 50	5 20	50	0 48
1 45	19 51	10 0	5 15	51	0 46
1 50	19 25	10 15	5 7	52	0 44
1 55	19 0	10 30	5 0	53	0 43
2 0	18 35	10 45	4 53	54	0 41
2 5	18 11	11 0	4 47	55	0 40
2 10	17 48	11 15	4 40	56	0 38
2 15	17 26	11 30	4 34	57	0 37
2 20	17 4	11 45	4 29	58	0 35
2 25	16 44	12 0	4 23	59	0 34
2 30	16 24	12 20	4 16	60	0 33
2 35	16 4	12 40	4 9	61	0 32
2 40	15 45	13 0	4 3	62	0 30
2 45	15 27	13 20	3 57	63	0 29
2 50	15 9	13 40	3 51	64	0 28
2 55	14 52	14 0	3 45	65	0 26
3 0	14 36	14 20	3 40	66	0 25
3 5	14 20	14 40	3 35	67	0 24
3 10	14 4	15 0	3 30	68	0 23
3 15	13 49	15 30	3 24	69	0 22
3 20	13 34	16 0	3 17	70	0 21
3 25	13 20	16 30	3 10	71	0 19
3 30	13 6	17 0	3 4	72	0 18
3 40	12 40	17 30	2 59	73	0 17
3 50	12 15	18 0	2 54	74	0 16
4 0	11 51	18 30	2 49	75	0 15
4 10	11 29	19 0	2 44	76	0 14
4 20	11 8	19 30	2 39	77	0 13
4 30	10 48	20 0	2 35	78	0 12
4 40	10 29	20 30	2 31	79	0 11
4 50	10 11	21 0	2 27	80	0 10
5 0	9 54	21 30	2 24	81	0 9
5 10	9 38	22 0	2 20	82	0 8
5 20	9 23	23 0	2 14	83	0 7
5 30	9 8	24 0	2 7	84	0 6
5 40	8 54	25 0	2 2	85	0 5
5 50	8 41	26 0	1 56	86	0 4
6 0	8 28	27 0	1 51	87	0 3
6 10	8 15	28 0	1 47	88	0 2
6 20	8 3	29 0	1 42	89	0 1

Table V.
Dip of the Horizon.

Height of eye.	Dip. of Horizon	Height of eye	Dip. of Horizon.	Height of eye.	Dip. of Horizon.	Height of eye.	Dip. of Horizon
Feet.	M. S.	Feet.	M. S.	Feet.	M. S.	Feet.	M. S.
1	0 57	11	3 10	21	4 22	35	5 39
2	1 21	12	3 18	22	4 28	40	6 2
3	1 39	13	3 26	23	4 34	45	6 24
4	1 55	14	3 34	24	4 40	50	6 44
5	2 8	15	3 42	25	4 46	55	7 4
6	2 20	16	3 49	26	4 52	60	7 23
7	2 31	17	3 56	27	4 58	70	7 59
8	2 42	18	4 3	28	5 3	80	8 32
9	2 52	19	4 10	29	5 9	90	9 3
10	3 1	20	4 16	30	5 14	100	9 33

Table VI.
Dip of the Sea at different distances from the Observer.

Dist. of land in sea miles.	Height of the eye above the sea in feet.							
	5	10	15	20	25	30	35	40
	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.	Dip.
	M.	M.	M.	M.	M.	M.	M.	M.
0 ¼	11	22	34	45	56	68	79	90
0 ½	6	11	17	22	28	34	39	45
0 ¾	4	8	12	15	19	23	27	30
1 0	4	6	9	12	15	17	20	23
1 ¼	3	5	7	9	12	14	16	19
1 ½	3	4	6	8	10	11	14	15
2 0	2	3	5	6	8	10	11	12
2 ½	2	3	5	6	7	8	9	10
3 0	2	3	4	5	6	7	8	8
3 ½	2	3	4	5	6	6	7	7
4 0	2	3	4	4	5	6	7	7
5 0	2	3	4	4	5	5	6	6
6 0	2	3	4	4	5	5	6	6

Table VII.
The Correction to be applied to the Time of High-water at Full and Change of the Moon, to find the time of High-water on any other day.

Interval of Time.	After New or Full Moon	Before 1st or 3d Quarter.	After 1st or 3d Quarter	Before New or Full Moon
	Additive.	Additive.	Additive.	Subtractive.
D. H.	H. M.	H. M	H. M.	H. M.
0 0	0 0	5 6	5 6	0 0
0 6	0 8	4 51	5 22	0 9
0 12	0 17	4 37	5 40	0 18
0 18	0 26	4 23	6 0	0 27
1 0	0 36	4 9	6 20	0 37
1 6	0 45	3 56	6 39	0 47
1 12	0 54	3 44	6 58	0 57
1 18	1 2	3 32	7 18	1 7
2 0	1 11	3 21	7 37	1 17
2 6	1 19	3 11	7 56	1 28
2 12	1 28	3 1	8 14	1 39
2 18	1 37	2 50	8 31	1 51
3 0	1 46	2 40	8 47	2 4
3 6	1 54	2 30	9 2	2 16
3 12	2 3	2 21	9 17	2 29
3 18	2 12	2 12	9 31	2 44
4 0	2 21	2 3	9 44	2 58

TABLE VIII. *Sun's Declination for* 1793, *being the first after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	22°57'1 S.	16°52'3 S.	7°17'0 S.	4°49'9 N	15°17'8 N	22° 9'6 N	23° 5'3 N	17°52'6 N	8° 3'0 N	3°27'7 S.	14 41'1 S.	21°56'9 S.
2	22 51.5	16 34.8	6 54.1	5 12.9	15 35.6	22 17.3	23 0.8	17 37.2	7 41.0	3 51.0	15 0.1	22 5.7
3	22 45.5	16 17.1	6 31.1	5 35.8	15 53.2	22 24.7	22 56.0	17 21.4	7 18.9	4 14.3	15 18.9	22 14.1
4	22 39.0	15 59.0	6 8.0	5 58.7	16 10.5	22 31.6	22 50.7	17 5.4	6 56.7	4 37.5	15 37.4	22 22.0
5	22 32.1	15 40.7	5 44.8	6 21.4	16 27.5	22 38.1	22 45.0	16 49.1	6 34.4	5 0.7	15 55.6	22 29.5
6	22 24.7	15 22.1	5 21.6	6 44.0	16 44.3	22 44.3	22 38.9	16 32.5	6 11.9	5 23.8	16 13.6	22 36.6
7	22 16.9	15 3.3	4 58.2	7 6.6	17 0.9	22 50.0	22 32.4	16 15.7	5 49.4	5 46.8	16 31.2	22 43
8	22 8.6	14 44.2	4 34.8	7 28.9	17 17.1	22 55.4	22 25.6	15 58.5	5 26.8	6 9.7	16 48.7	22 49.4
9	21 59.9	14 24.8	4 11.4	7 51.2	17 33.0	23 0.3	22 18.3	15 41.2	5 4.0	6 32.6	17 5.8	22 55.1
10	21 50.8	14 5.2	3 47.9	8 13.3	17 48.7	23 4.9	22 10.7	15 23.5	4 41.2	6 22.4	17 22.6	23 0.4
11	21 41.3	13 45.4	3 24.3	8 35.3	18 4.0	23 9.0	22 2.7	15 5.7	4 18.3	7 18.0	17 39.1	23 5.2
12	21 31.3	13 25.4	3 0.7	8 57.2	18 19.1	23 12.7	21 54.3	15 47.6	3 55.4	7 40.6	17 55.3	23 9.6
13	21 20.9	13 5.1	2 37.0	9 18.9	18 33.8	23 16.0	21 45.5	14 29.2	3 32.3	8 3.1	18 11.2	23 13.5
14	21 10.8	12 44.6	2 13.4	9 40.4	18 48.2	23 18.9	21 36.3	14 10.7	3 9.2	8 25.4	18 26.8	23 16.9
15	20 58.9	12 23.9	1 49.7	10 1.8	19 2.3	23 21.4	21 26.8	13 51.9	2 46.1	8 47.7	18 42.1	23 19.9
16	20 47.3	12 3.1	1 26.0	10 23.1	19 16.1	23 23.5	21 17.0	13 32.9	2 22.9	9 9.8	18 57.0	23 22.4
17	20 35.4	11 42.0	1 2.3	10 44.1	19 29.6	23 25.2	21 6.7	13 13.6	1 59.6	9 31.7	19 11.6	23 24.4
18	20 23.0	11 20.8	0 38.6	11 5.0	19 42.7	23 26.5	20 56.1	12 54.2	1 36.4	9 53.6	19 25.8	23 26.0
19	20 10.2	10 59.4	0 14.9 S.	11 25.7	19 55.5	23 27.3	20 45.2	12 34.6	1 13.0	10 15.3	19 39.7	23 27.0
20	19 57.1	10 37.8	0 8.7 N.	11 46.2	20 8.0	23 27.7	20 33.9	12 14.7	0 49.7	10 36.8	19 53.2	23 27.7
21	19 43.6	10 16.3	0 32.4	12 6.5	20 20.1	23 27.8	20 22.3	11 54.7	0 26.3	10 58.2	20 6.4	23 27.8
22	19 29.7	9 54.1	0 56.0	12 26.6	20 31.9	23 27.3	20 10.3	11 34.5	0 2.9 N	11 19.4	20 19.2	23 27.5
23	19 15.5	9 32.1	1 19.7	12 46.5	20 43.3	23 26.6	19 58.0	11 14.1	0 20.5 S	11 40.4	20 31.6	23 26.7
24	19 0.9	9 9.9	1 43.2	13 6.2	20 54.3	23 25.3	19 45.3	10 53.5	0 43.9	12 1.3	20 43.7	23 25.4
25	18 46.0	8 47.6	2 6.8	13 25.7	21 5.0	23 23.7	19 32.3	10 32.7	1 7.4	12 22.0	20 55.3	23 23.7
26	18 30.7	8 25.1	2 30.2	13 44.9	21 15.4	23 21.7	19 19.0	10 11.8	1 30.8	12 42.5	21 6.6	23 21.5
27	18 15.1	8 2.6	2 53.7	14 4.0	21 25.3	23 19.2	19 5.4	9 50.7	1 54.2	13 2.8	21 17.5	23 18.8
28	17 59.2	7 39.9	3 17.1	14 22.8	21 34.9	23 16.4	18 51.5	9 29.5	2 17.6	13 22.9	21 27.9	23 15.6
29	17 42.9		3 40.4	14 41.3	21 44.2	23 13.1	18 37.2	9 8.1	2 41.0	13 42.8	21 38.0	23 12.0
30	17 26.4		4 3.6	14 59.7	21 53.0	23 9.4	18 22.6	8 46.5	3 4.4	14 2.5	21 47.6	23 7.9
31	17 9.5		4 26.8		22 1.5		18 7.8	8 24.8		14 21.9		23 3.4

TABLE VIII. *Sun's Declination for* 1794, *being the second after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	22°58'4 S.	16°56'5 S.	7°22'6 S.	4°44'3 N	15°13'0 N	22° 7'7 N	23° 6.4 N	17°56'3 N	8° 8'2 N	3°22'2 S.	14°36'5 S.	21°54'7 S
2	22 52.9	16 39.1	6 59.7	5 7.4	15 31.3	22 15.5	23 2.0	17 40.9	7 46.3	3 45.5	14 55.6	22 3.6
3	22 47.0	16 21.4	6 36.7	5 30.4	15 49.0	22 23.0	22 57.2	17 25.2	7 24.2	4 8.7	15 14.3	22 12.1
4	22 40.6	16 3.4	6 13.6	5 53.2	16 6.4	22 30.0	22 52.0	17 9.2	7 2.1	4 31.9	15 32.9	22 20.1
5	22 33.8	15 45.1	5 50.4	6 16.0	16 23.5	22 36.6	22 46.4	16 53.0	6 39.8	4 55.1	15 51.2	22 27.7
6	22 26.5	15 26.6	5 27.2	6 38.6	16 40.3	22 42.8	22 40.4	16 36.5	6 17.4	5 18.1	16 9.2	22 34.9
7	22 18.8	15 7.8	5 3.8	7 1.2	16 56.9	22 48.7	22 34.0	16 19.7	5 54.9	5 41.2	16 26.9	22 46.6
8	22 10.7	14 48.8	4 40.5	7 23.6	17 13.2	22 54.1	22 27.3	16 2.7	5 32.3	6 4.1	16 44.4	22 47.9
9	22 2.1	14 29.5	4 17.0	7 45.8	17 29.2	22 59.2	22 20.1	15 45.4	5 9.6	6 27.0	17 1.6	22 53.7
10	21 53.1	14 10.0	3 53.5	8 8.0	17 44.9	23 3.8	22 12.6	15 27.9	4 46.8	6 49.7	17 18.4	22 59.1
11	21 43.6	13 50.2	3 30.0	8 30.0	18 0.3	23 8.0	22 4.7	15 10.1	4 24.0	7 12.4	17 35.0	23 4.1
12	21 33.8	13 30.3	3 6.4	8 51.9	18 15.4	23 11.9	21 56.4	14 52.1	4 1.0	7 35.0	17 51.3	23 8.5
13	21 23.5	13 10.1	2 42.8	9 13.6	18 30.2	23 15.3	21 47.7	14 33.8	3 38.0	7 57.5	18 7.3	23 12.5
14	21 12.8	12 49.7	2 19.2	9 35.2	18 44.7	23 18.3	21 38.6	14 15.3	3 15.0	8 19.9	18 23.0	23 16.1
15	21 1.7	12 29.1	1 55.5	9 56.6	18 58.9	23 20.9	21 29.2	13 56.5	2 51.8	8 42.2	18 38.3	23 19.2
16	20 50.2	12 8.2	1 31.8	10 17.8	19 12.8	23 23.1	21 19.4	13 37.6	2 28.6	9 4.3	18 53.3	23 21.8
17	20 38.4	11 47.2	1 8.2	10 38.9	19 26.3	23 24.8	21 9.3	13 18.4	2 5.4	9 26.3	19 8.0	23 23.9
18	20 26.1	11 26.1	0 44.5	10 59.8	19 39.5	23 26.2	20 58.8	12 59.0	1 42.1	9 48.2	19 22.3	23 25.6
19	20 13.4	11 4.7	0 20.8 S.	10 20.6	19 52.4	23 27.2	20 47.9	12 39.4	1 18.8	10 9.9	19 36.3	23 26.8
20	20 0.4	10 43.1	0 2.9 N	11 41.1	20 4.9	23 27.7	20 36.7	12 19.6	0 55.4	10 31.5	19 50.0	23 27.6
21	19 47.0	10 21.4	0 26.5	12 1.5	20 17.1	23 27.8	20 25.2	11 59.6	0 32.0	10 53.0	20 3.2	23 27.8
22	19 33.2	9 59.6	0 50.2	12 21.6	20 29.0	23 27.5	20 13.2	11 39.4	0 8.6 N	11 14.2	20 16.1	23 27.6
23	19 19.0	9 37.5	1 13.8	12 41.6	20 40.5	23 26.8	20 1.0	11 19.0	0 14.8 S	11 35.3	20 28.6	23 26.9
24	19 4.5	9 15.4	1 37.4	13 1.4	20 51.6	23 25.7	19 48.4	10 58.5	0 38.3	11 56.3	20 40.8	23 25.1
25	18 49.7	8 53.1	2 1.0	13 20.9	21 2.4	23 24.2	19 35.5	10 37.8	1 1.7	12 17.0	20 52.6	23 24.2
26	18 34.5	8 30.6	2 24.5	13 40.2	21 12.9	23 22.2	19 22.3	10 16.8	1 25.2	12 37.6	21 3.9	23 22.1
27	18 18.9	8 8.1	2 47.9	13 59.3	21 23.0	23 19.9	19 8.7	9 55.8	1 48.6	12 57.9	21 14.9	23 19.5
28	18 3.1	7 45.4	3 11.4	14 18.2	21 32.7	23 17.1	18 54.8	9 34.6	2 12.0	13 18.1	21 25.5	23 16.5
29	17 46.9		3 34.7	14 36.9	21 42.0	23 13.9	18 40.7	9 13.2	2 35.4	13 38.0	21 35.6	23 13.0
30	17 30.4		3 58.0	14 54.2	21 50.9	23 10.4	18 26.2	8 51.7	2 58.8	13 57.8	21 45.4	23 9.0
31	17 13.6		4 21.2		21 59.5		18 11.4	8 30.0		14 17.3		23 4.6

TABLE VIII. *Sun's Declination for 1795, being the third after leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	22° 59'7 S	17° 0'7 S	7° 28'1 S	4° 38'8 N	15° 9'1 N	22° 5'8 N	23° 7'4 N	18° 0'0 N	8° 13'5 N	3° 16'4 S	14° 31'8 S	21° 52'4 S
2	22 54.3	16 43.4	7 5.3	5 1.8	15 27.1	22 13.7	23 3.1	17 44.7	7 51.7	3 39.7	14 50.9	21 1.4
3	22 48.5	16 25.8	6 42.3	5 24.8	15 44.8	22 21.2	22 58.4	17 29.1	7 29.6	4 3.0	15 9.7	22 10.0
4	22 42.3	16 7.9	6 19.3	5 47.7	16 2.2	22 28.3	22 53.3	17 13.2	7 7.5	4 26.2	15 28.3	22 18.2
5	22 35.5	15 49.7	5 56.1	6 10.4	16 19.4	22 35.0	22 47.8	16 57.0	6 45.2	4 49.4	15 46.7	22 25.9
6	22 28.4	15 31.3	5 32.9	6 33.1	16 36.3	22 41.4	22 42.0	16 40.6	6 22.9	5 12.5	16 4.8	22 33.2
7	22 20.8	15 12.5	5 9.6	6 55.6	16 52.9	22 47.3	22 35.7	16 23.9	6 0.4	5 35.5	16 22.6	22 40.0
8	22 12.8	14 53.6	4 46.3	7 18.1	17 9.3	22 52.9	22 29.0	16 6.9	5 37.8	5 58.5	16 40.1	22 46.4
9	22 4.3	14 34.4	4 22.8	7 40.4	17 25.3	22 58.0	22 21.9	15 49.7	5 15.1	6 21.4	16 57.4	22 52.4
10	21 55.4	14 14.9	3 59.4	8 2.6	17 41.1	23 2.7	22 14.5	15 32.2	4 52.4	6 44.2	17 14.4	22 57.9
11	21 46.0	13 55.2	3 35.8	8 24.6	17 56.6	23 7.1	22 6.7	15 14.4	4 29.5	7 6.9	17 31.0	23 2.9
12	21 36.3	13 35.3	3 12.3	8 46.5	18 11.8	23 11.0	21 58.4	14 56.4	4 6.6	7 29.6	17 47.4	23 7.5
13	21 26.1	13 15.1	2 48.6	9 8.3	18 26.7	23 14.5	21 49.8	14 38.2	3 43.6	7 52.1	18 3.5	23 11.7
14	21 15.5	12 54.8	2 25.0	9 29.9	18 41.3	23 17.6	21 40.9	14 19.7	3 20.5	8 14.5	18 19.2	23 15.3
15	21 4.5	12 34.2	2 1.3	9 51.4	18 55.6	23 20.3	21 31.5	14 1.0	2 57.4	8 36.8	18 34.7	23 18.5
16	20 53.1	12 13.4	1 37.7	10 12.7	19 9.5	23 22.6	21 21.9	13 42.1	2 34.2	8 59.0	18 49.8	23 21.2
17	20 41.3	11 52.4	1 13.9	10 33.9	19 24.1	23 24.5	21 11.8	13 23.0	2 10.9	9 21.1	19 4.5	23 23.5
18	20 29.2	11 31.3	0 50.2	10 54.8	19 36.4	23 25.9	21 1.3	13 3.6	1 47.6	9 43.0	19 18.9	23 25.3
19	20 16.6	11 9.9	0 26.5	11 15.6	19 49.4	23 27.0	20 50.6	12 44.1	1 24.3	10 4.8	19 33.0	23 26.6
20	20 3.6	10 48.4	0 2.8 S	11 36.2	20 2.0	23 27.6	20 39.4	12 24.3	1 0.9	10 26.4	19 46.7	23 27.5
21	19 50.3	10 26.7	0 20.8 N	11 56.7	20 14.3	23 27.9	20 27.9	12 4.4	0 37.6	10 47.8	20 0.1	23 27.9
22	19 36.6	10 4.9	0 44.5	12 16.9	20 26.2	23 27.7	20 16.1	11 44.2	0 14.2 N	11 9.1	20 13.1	23 27.8
23	19 22.5	9 42.9	1 8.1	12 36.9	20 37.8	23 27.0	20 4.0	11 23.9	0 9.2 S	11 30.3	20 25.7	23 27.2
24	19 8.1	9 20.7	1 31.8	12 56.7	20 49.1	23 26.0	19 51.5	11 3.4	0 32.7	11 51.2	20 37.9	23 26.2
25	18 53.3	8 58.5	1 55.3	13 16.3	21 0.0	23 24.6	19 38.6	10 42.7	0 56.1	12 12.0	20 49.7	23 24.6
26	18 38.2	8 36.1	2 18.9	13 35.7	21 10.5	23 22.7	19 25.5	10 21.9	1 19.5	12 32.6	21 1.2	23 22.7
27	18 22.8	8 13.5	2 42.3	13 54.8	21 20.6	23 20.5	19 12.0	10 0.9	1 42.9	12 53.0	21 12.2	23 20.2
28	18 7.0	7 50.9	3 5.8	14 13.8	21 30.4	23 17.8	18 58.2	9 39.7	2 6.3	13 13.2	21 22.9	23 17.3
29	17 50.9		3 29.1	14 32.5	21 39.8	23 14.8	18 44.1	9 18.4	2 29.7	13 33.2	21 33.1	23 13.9
30	17 34.5		3 52.4	14 50.9	21 48.9	23 11.3	18 29.7	8 56.9	2 53.1	13 52.9	21 43.0	23 10.1
31	17 17.7		4 15.6		21 57.5		18 15.0	8 35.3		14 12.		

TABLE VIII. *Sun's Declination for 1796, being leap year.*

Days.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.
1	23° 1'0 S	17° 5'0 S	7° 11'0 S	4° 56'1 N	15° 22'7 N	22° 11'8 N	23° 4'2 N	17° 48'5 N	7° 57'0 N	3° 34'1 S	14° 46'4 S	21° 59'4 S
2	22 55.7	16 47.8	6 48.0	5 19.1	15 40.5	22 19.5	22 59.6	17 32.9	7 35.0	3 57.4	15 5.3	22 8.1
3	22 50.0	16 30.2	6 25.0	5 42.1	15 58.0	22 26.7	22 54.6	17 17.1	7 12.9	4 20.6	15 24.0	22 16.3
4	22 43.9	16 12.4	6 1.9	6 4.9	16 15.2	22 33.5	22 49.2	17 1.0	6 50.6	4 43.8	15 42.4	22 24.2
5	22 37.3	15 54.2	5 38.6	6 27.6	16 32.2	22 39.9	22 43.4	16 44.6	6 28.3	5 7.0	16 0.5	22 31.6
6	22 30.2	15 35.8	5 15.4	6 50.2	16 49.0	22 46.0	22 37.3	16 27.9	6 5.8	5 30.0	16 18.4	22 38.5
7	22 22.7	15 17.2	4 52.0	7 12.7	17 5.4	22 51.6	22 30.7	16 11.0	5 43.2	5 53.0	16 36.0	22 45.0
8	22 14.8	14 58.3	4 28.6	7 35.0	17 21.6	22 56.9	22 23.7	15 53.8	5 20.6	6 16.0	16 53.3	22 51.1
9	22 6.4	14 39.1	4 5.1	7 57.3	17 37.4	23 1.7	22 16.3	15 36.4	4 57.8	6 38.8	17 10.4	22 56.7
10	21 57.6	14 19.7	3 41.5	8 19.4	17 53.0	23 6.1	22 8.6	15 18.7	4 35.0	7 1.5	17 27.1	23 1.8
11	21 48.4	14 0.0	3 18.0	8 41.3	18 8.2	23 10.1	22 0.5	15 0.8	4 12.1	7 24.2	17 43.6	23 6.5
12	21 38.7	13 40.1	2 54.3	9 3.1	18 23.2	23 13.8	21 52.0	14 42.6	3 49.1	7 46.7	17 59.7	23 10.7
13	21 28.7	13 20.0	2 30.7	9 24.8	18 37.9	23 17.0	21 43.1	14 24.2	3 26.1	8 9.1	18 15.5	23 14.5
14	21 18.2	12 59.7	2 7.0	9 46.3	18 52.2	23 19.8	21 33.9	14 5.6	3 3.0	8 31.5	18 31.0	23 17.8
15	21 7.3	12 39.2	1 43.4	10 7.7	19 6.2	23 22.1	21 24.2	13 46.8	2 39.8	8 53.6	18 46.2	23 20.7
16	20 56.0	12 18.5	1 19.7	10 28.8	19 19.9	23 24.1	21 14.3	13 27.7	2 16.6	9 15.7	19 1.0	23 23.0
17	20 44.3	11 57.5	0 56.0	10 49.8	19 33.3	23 25.7	21 3.9	13 8.4	1 53.3	9 37.6	19 15.5	23 24.9
18	20 32.2	11 36.4	0 32.3	11 10.7	19 46.3	23 26.8	20 53.3	12 48.9	1 30.1	9 59.4	19 29.6	23 26.4
19	20 19.7	11 15.2	0 8.6 S	11 31.3	19 59.0	23 27.5	20 42.2	12 29.2	1 6.7	10 21.1	19 43.4	23 27.3
20	20 6.9	10 53.7	0 15.1 N	11 51.7	20 11.4	23 27.9	20 30.8	12 9.3	0 43.3	10 42.6	19 56.9	23 27.8
21	19 53.6	10 32.1	0 38.7	12 12.0	20 23.4	23 27.8	20 19.1	11 49.3	0 20.0 N	11 3.9	20 9.9	23 27.9
22	19 40.0	10 10.3	1 2.4	12 32.0	20 35.1	23 27.3	20 7.0	11 29.0	0 3.4 S	11 25.1	20 22.6	23 27.4
23	19 26.1	9 48.4	1 26.0	12 51.9	20 46.4	23 26.3	19 54.6	11 8.5	0 26.9	11 46.1	20 35.0	23 26.5
24	19 11.7	9 26.3	1 49.5	13 11.5	20 57.4	23 25.0	19 41.9	10 47.9	0 50.3	12 7.0	20 46.9	23 25.1
25	18 57.1	9 4.0	2 13.1	13 30.9	21 8.0	23 23.3	19 28.8	10 27.1	1 13.7	12 27.6	20 58.5	23 23.2
26	18 42.0	8 41.7	2 36.6	13 50.2	21 18.2	23 21.1	19 15.4	10 6.1	1 37.2	12 48.0	21 9.6	23 20.9
27	18 26.7	8 19.2	3 0.0	14 9.1	21 28.5	23 18.6	19 1.7	9 45.0	2 0.6	13 8.3	21 20.4	23 18.1
28	18 11.0	7 56.6	3 23.3	14 27.9	21 37.6	23 15.6	18 47.6	9 23.7	2 24.0	13 28.4	21 30.8	23 14.8
29	17 55.0	7 33.8	3 46.6	14 46.4	21 46.7	23 12.2	18 33.3	9 2.2	2 47.4	13 48.2	21 40.7	23 11.1
30	17 38.6		4 9.9	15 4.7	21 55.5	23 8.4	18 18.6	8 40.6	3 10.8	14 7.8	21 50.3	23 6.8
31	17 22.0		4 33.0		22 3.8		18 3.7	8 18.9		14 27.2		23 2.2

TABLE IX. To reduce the Sun's Declination to any other Meridian, and to any given Time under that Meridian.

Add in W. Sub. in E.		Sub. in W. Add in E.		10°	20°	30°	40°	50°	60°	70°	80°	90°	100°	110°	120°	130°	140°	150°	160°	170°	180°	Add in W. Sub. in E.		Sub. in W. Add in E.	
				LONGITUDE.																					
December.	21	December.	21	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	21	June.	21	June.
	20		22	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	20		22	
	19		23	0.0	0.0	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.4	0.4	19		23	
	18		24	0.0	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.6	0.6	18		24	
	17		25	0.1	0.1	0.1	0.2	0.2	0.3	0.3	0.4	0.4	0.5	0.5	0.6	0.6	0.7	0.7	0.8	0.8	0.9	17		25	
	16		26	0.1	0.1	0.2	0.2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.8	0.8	0.9	1.0	1.0	1.1	16		26	
	15		27	0.1	0.1	0.2	0.3	0.4	0.4	0.5	0.6	0.7	0.8	0.8	0.9	0.9	1.0	1.1	1.2	1.2	1.3	15		27	
	14		28	0.1	0.2	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	0.9	1.0	1.1	1.2	1.3	1.4	1.4	1.5	14		28	
	13		29	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.8	13		29	
	12		30	0.1	0.2	0.3	0.4	0.5	0.7	0.8	0.9	1.0	1.1	1.2	1.3	1.4	1.5	1.6	1.7	1.9	2.0	12		30	
December.	11		31	0.1	0.2	0.4	0.5	0.6	0.7	0.8	1.0	1.1	1.2	1.3	1.5	1.6	1.7	1.8	1.9	2.1	2.2	11	June.	1	July.
	10	January.	1	0.1	0.3	0.4	0.5	0.7	0.8	0.9	1.1	1.2	1.3	1.5	1.6	1.7	1.9	2.0	2.1	2.3	2.4	10		2	
	9		2	0.1	0.3	0.4	0.6	0.7	0.9	1.0	1.2	1.3	1.5	1.6	1.8	1.9	2.0	2.2	2.3	2.5	2.6	9		3	
	8		3	0.1	0.3	0.5	0.6	0.8	0.9	1.1	1.3	1.4	1.6	1.7	1.9	2.1	2.2	2.4	2.5	2.7	2.8	8		4	
	7		4	0.2	0.3	0.5	0.7	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.0	2.2	2.4	2.6	2.7	2.9	3.1	7		5	
	6		5	0.2	0.4	0.5	0.7	0.9	1.1	1.3	1.4	1.6	1.8	2.0	2.2	2.4	2.5	2.7	2.9	3.1	3.3	6		6	
	5		6	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.5	1.7	1.9	2.1	2.3	2.5	2.7	2.9	3.1	3.3	3.5	5		7	
	4		7	0.2	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.0	2.3	2.5	2.7	2.9	3.1	3.3	3.5	3.7	4		8	
	3		8	0.2	0.4	0.6	0.9	1.1	1.3	1.5	1.7	1.9	2.2	2.4	2.6	2.8	3.0	3.2	3.5	3.7	3.9	3		9	
	2		9	0.2	0.4	0.7	0.9	1.1	1.4	1.6	1.8	2.0	2.3	2.5	2.7	3.0	3.2	3.4	3.6	3.9	4.1	2		10	
November.	1	January.	10	0.2	0.5	0.7	0.9	1.2	1.4	1.7	1.9	2.1	2.4	2.6	2.9	3.1	3.3	3.6	3.8	4.1	4.3	1	May.	11	July.
	30		11	0.2	0.5	0.7	1.0	1.2	1.5	1.7	2.0	2.2	2.5	2.7	3.0	3.2	3.5	3.7	4.0	4.2	4.5	31		12	
	29		12	0.3	0.5	0.8	1.0	1.3	1.6	1.8	2.1	2.3	2.6	2.9	3.1	3.4	3.6	3.9	4.2	4.4	4.7	30		13	
	28		13	0.3	0.5	0.8	1.1	1.4	1.6	1.9	2.2	2.4	2.7	3.0	3.3	3.5	3.8	4.1	4.3	4.6	4.9	29		14	
	27		14	0.3	0.6	0.8	1.1	1.4	1.7	2.0	2.3	2.5	2.8	3.1	3.4	3.7	4.0	4.2	4.5	4.8	5.1	28		15	
	26		15	0.3	0.6	0.9	1.2	1.5	1.8	2.0	2.3	2.6	2.9	3.2	3.5	3.8	4.1	4.4	4.7	5.0	5.3	27		16	
	2.		16	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7	3.0	3.3	3.6	3.9	4.3	4.6	4.9	5.2	5.5	26		17	
	24		17	0.3	0.6	0.9	1.3	1.6	1.9	2.2	2.5	2.8	3.1	3.5	3.8	4.1	4.4	4.7	5.0	5.3	5.7	25		18	
	23		18	0.3	0.6	1.0	1.3	1.6	1.9	2.3	2.6	2.9	3.2	3.6	3.9	4.2	4.5	4.9	5.2	5.5	5.8	24		19	
	22		19	0.3	0.7	1.0	1.3	1.7	2.0	2.3	2.7	3.0	3.3	3.7	4.0	4.3	4.7	5.0	5.4	5.7	6.0	23		20	
November.	21	January.	20	0.3	0.7	1.0	1.4	1.7	2.1	2.4	2.8	3.1	3.4	3.8	4.1	4.5	4.8	5.2	5.5	5.9	6.2	22	May.	21	July.
	20		21	0.4	0.7	1.1	1.4	1.8	2.1	2.5	2.8	3.2	3.5	3.9	4.3	4.6	5.0	5.3	5.7	6.0	6.4	21		22	
	19		22	0.4	0.7	1.1	1.5	1.8	2.2	2.5	2.9	3.3	3.6	4.0	4.4	4.7	5.1	5.5	5.8	6.2	6.6	20		23	
	18		23	0.4	0.7	1.1	1.5	1.9	2.2	2.6	3.0	3.4	3.7	4.1	4.5	4.9	5.2	5.6	6.0	6.4	6.7	19		24	
	17		24	0.4	0.8	1.1	1.5	1.9	2.3	2.7	3.1	3.4	3.8	4.2	4.6	5.0	5.4	5.7	6.1	6.5	6.9	18		25	
	16		25	0.4	0.8	1.2	1.6	2.0	2.3	2.7	3.1	3.5	3.9	4.3	4.7	5.1	5.5	5.9	6.3	6.7	7.1	17		26	
	15		26	0.4	0.8	1.2	1.6	2.0	2.4	2.8	3.2	3.6	4.0	4.4	4.8	5.2	5.6	6.0	6.4	6.8	7.2	16		27	
	14		27	0.4	0.8	1.2	1.6	2.1	2.5	2.9	3.3	3.7	4.1	4.5	4.9	5.3	5.8	6.2	6.6	7.0	7.4	15		28	
	13		28	0.4	0.8	1.3	1.7	2.1	2.5	2.9	3.4	3.8	4.2	4.6	5.0	5.5	5.9	6.3	6.7	7.1	7.6	14		29	
	11		30	0.4	0.9	1.3	1.7	2.2	2.6	3.1	3.5	3.9	4.4	4.8	5.2	5.7	6.1	6.6	7.0	7.4	7.9	12		31	
November.	9	February.	1	0.4	0.9	1.4	1.8	2.3	2.7	3.2	3.6	4.1	4.5	5.0	5.4	5.9	6.4	6.8	7.3	7.7	8.2	10	May.	2	August.
	7		3	0.5	0.9	1.4	1.9	2.3	2.8	3.3	3.8	4.2	4.7	5.2	5.6	6.1	6.6	7.0	7.5	8.0	8.5	8		4	
	5		5	0.5	1.0	1.4	1.9	2.4	2.9	3.4	3.9	4.3	4.8	5.3	5.8	6.3	6.8	7.3	7.7	8.2	8.7	6		6	
	3		7	0.5	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	5.5	6.0	6.5	7.0	7.5	8.0	8.5	9.0	4		8	
	1		9	0.5	1.0	1.5	2.0	2.5	3.1	3.6	4.1	4.6	5.1	5.6	6.1	6.7	7.2	7.7	8.2	8.7	9.2	2		10	
October.	30		11	0.5	1.0	1.6	2.1	2.6	3.1	3.7	4.2	4.7	5.3	5.8	6.3	6.8	7.3	7.9	8.4	8.9	9.5	30	April.	12	
	28		13	0.5	1.1	1.6	2.1	2.7	3.2	3.8	4.3	4.8	5.4	5.9	6.5	7.0	7.5	8.1	8.6	9.1	9.7	28		14	
	26		15	0.5	1.1	1.6	2.2	2.7	3.3	3.8	4.4	4.9	5.5	6.0	6.6	7.2	7.7	8.2	8.8	9.3	9.9	26		16	
	24		17	0.6	1.1	1.7	2.2	2.8	3.4	3.9	4.5	5.0	5.6	6.2	6.7	7.3	7.9	8.4	9.0	9.6	10.1	24		18	
	21		20	0.6	1.1	1.7	2.3	2.9	3.5	4.0	4.6	5.2	5.8	6.3	6.9	7.5	8.1	8.7	9.2	9.8	10.4	21		21	
October.	18	February.	23	0.6	1.2	1.8	2.4	3.0	3.5	4.1	4.7	5.3	5.9	6.5	7.1	7.7	8.3	8.9	9.5	10.0	10.6	18	April.	24	August.
	15		26	0.6	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	7.9	8.5	9.1	9.7	10.3	10.9	15		27	
	12	March.	1	0.6	1.2	1.8	2.5	3.1	3.7	4.3	4.9	5.5	6.2	6.8	7.4	8.0	8.6	9.2	9.8	10.5	11.1	12		30	
	9		4	0.6	1.2	1.9	2.5	3.1	3.7	4.4	5.0	5.6	6.3	6.9	7.5	8.1	8.8	9.4	10.0	10.6	11.3	9		2	September.
	6		7	0.6	1.3	1.9	2.5	3.2	3.8	4.4	5.1	5.7	6.3	7.0	7.6	8.2	8.9	9.5	10.1	10.8	11.4	6		5	
	3		10	0.6	1.3	1.9	2.6	3.2	3.8	4.5	5.1	5.8	6.4	7.0	7.7	8.3	9.0	9.6	10.3	10.9	11.5	3		8	
Septem.	30		13	0.6	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.7	8.4	9.0	9.7	10.3	11.0	11.6	31	March.	11	
	27		16	0.7	1.3	1.9	2.6	3.2	3.9	4.5	5.2	5.8	6.5	7.1	7.8	8.4	9.1	9.7	10.4	11.0	11.7	28		14	
	24		19	0.7	1.3	2.0	2.6	3.2	3.9	4.5	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7	25		17	
	21		22	0.7	1.3	2.0	2.6	3.3	3.9	4.6	5.2	5.9	6.5	7.2	7.8	8.5	9.1	9.8	10.4	11.1	11.7	22		20	
Add aft. N. Sub. bef. N.		Sub aft. N. Add bef. N.		$0^h \frac{2}{3}$	$1^h \frac{1}{3}$	$2^h 0$	$2^h \frac{2}{3}$	$3^h \frac{1}{3}$	$4^h 0$	$4^h \frac{2}{3}$	$5^h \frac{1}{3}$	$6^h 0$	$6^h \frac{2}{3}$	$7^h \frac{1}{3}$	$8^h 0$	$8^h \frac{2}{3}$	$9^h \frac{1}{3}$	$10^h 0$	$10^h \frac{2}{3}$	$11^h \frac{1}{3}$	$12^h 0$	Add aft. N. Sub. bef. N.		Sub. aft. N. Add bef. N.	
				Time from Noon.																					

TABLE X. *Change of Sun's Declin.*

Mont.	Days.	Complete Years. 4	8	12	16
January.	1	0′ — 1	0′ — 3	0′ — 4	0′ — 6
	7	0 .2	0 .4	0 .7	0 .9
	13	0 .3	0 .6	0 .9	1 .2
	19	0 .4	0 .7	1 .1	1 .4
	25	0 .4	0 .8	1 .3	1 .7
February.	1	0 .5	1 .0	1 .5	2 .0
	7	0 .5	1 .1	1 .6	2 .2
	13	0 .6	1 .2	1 .7	2 .3
	19	0 .6	1 .2	1 .9	2 .5
	25	0 .7	1 .3	2 .0	2 .6
March.	1	0 .7	1 .3	2 .0	2 .7
	7	0 .7	1 .4	2 .1	2 .7
	13	0 .7	1 .4	2 .1	2 .8
	19	0 .7	1 .4	2 .1	2 .8
	25	0 + 7	1 + 4	2 + 1	2 + 8
April.	1	0 .7	1 .4	2 .1	2 .8
	7	0 .7	1 .4	2 .1	2 .7
	13	0 .7	1 .3	2 .0	2 .6
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .6	1 .2	1 .8	2 .4
May.	1	0 .6	1 .1	1 .7	2 .3
	7	0 .5	1 .0	1 .6	2 .1
	13	0 .5	0 .9	1 .4	1 .9
	19	0 .4	0 .8	1 .2	1 .6
	25	0 .3	0 .7	1 .0	1 .3
June.	1	0 .3	0 .5	0 .8	1 .0
	7	0 .2	0 .4	0 .5	0 .7
	13	0 .1	0 .2	0 .3	0 .4
	19	0 .0	0 .0	0 .1	0 .1
	25	0 — 1	0 — 1	0 — 2	0 — 3
July.	1	0 .1	0 .3	0 .4	0 .6
	7	0 .2	0 .4	0 .7	0 .9
	13	0 .3	0 .6	0 .9	1 .2
	19	0 .4	0 .7	1 .1	1 .4
	25	0 .4	0 .9	1 .3	1 .7
August.	1	0 .5	1 .0	1 .5	2 .0
	7	0 .5	1 .1	1 .6	2 .2
	13	0 .6	1 .2	1 .8	2 .4
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .7	1 .3	2 .0	2 .6
September.	1	0 .7	1 .4	2 .0	2 .7
	7	0 .7	1 .4	2 .1	2 .8
	13	0 .7	1 .4	2 .1	2 .8
	19	0 .7	1 .4	2 .1	2 .9
	25	0 + 7	1 + 4	2 + 1	2 + 8
October.	1	0 .7	1 .4	2 .1	2 .8
	7	0 .7	1 .4	2 .0	2 .7
	13	0 .7	1 .3	2 .0	2 .6
	19	0 .6	1 .3	1 .9	2 .5
	25	0 .6	1 .2	1 .8	2 .4
November.	1	0 .5	1 .1	1 .6	2 .2
	7	0 .5	1 .0	1 .5	2 .0
	13	0 .4	0 .9	1 .3	1 .8
	19	0 .4	0 .8	1 .2	1 .5
	25	0 .3	0 .7	1 .0	1 .3
December.	1	0 .2	0 .5	0 .7	1 .0
	7	0 .2	0 .4	0 .5	0 .7
	13	0 .1	0 .2	0 .3	0 .4
	19	0 .0	0 .0	0 .1	0 .1
	25	0 — 1	0 — 1	0 — 1	0 — 2

TABLE XI. *The Right Ascensions and Declinations of the principal fixed Stars, adapted to the beginning of the Year* 1793.

Name of Stars.	Mag.	Right Ascen. in Time. h	m	s	Ann. Var.	Declination. °	′	″	Ann. Var.
γ Pegasi	2	0h	2′	35″	3″.06	14°	1′	55 N	+20″.0
β Ceti	2	0	33	11	3 .01	19	7	32 S	—19 .8
Alrucabah, pole star	2.3	0	50	44	12 .42	88	12	8 N	+19 .6
Mirach	2	0	58	10	3 .31	34	31	13 N	+19 .4
Achernar	1	1	30	0	2 .25	58	17	33 S	—18 .5
Almaach	2	1	51	15	3 .62	41	19	47 N	+17 .7
Menkar	2	2	51	28	3 .11	3	16	17 N	+14 .7
Algol	Var.	2	54	45	3 .85	40	8	47 N	+14 .5
Algenib	2	3	9	38	4 .21	49	6	40 N	+13 .6
Aldebaran	1	4	24	3	3 .42	16	4	48 N	+ 8 .2
Capella	1	5	1	25	4 .41	45	46	15 N	+ 5 .1
Rigel	1	5	4	31	2 .87	8	27	9 S	— 4 .8
β Tauri	2	5	13	13	3 .78	28	25	1 N	+ 4 .1
Bellatrix	2	5	14	3	3 .21	6	8	53 N	+ 4 .0
δ Orionis	2	5	21	27	3 .07	0	27	50 S	— 3 .4
ε Orionis	2	5	25	44	3 .04	1	20	48 S	— 3 .0
ζ Orionis	2	5	30	20	3 .03	2	3	52 S	— 2 .6
α Columbæ	2	5	32	10	2 .17	34	11	34 S	— 2 .4
Betelguese	1	5	43	58	3 .24	7	21	17 N	+ 1 .4
β Canis Majoris	2.3	6	13	37	2 .65	17	51	56 S	+ 1 .2
Canopus	1	6	19	22	1 .33	52	35	16 S	+ 1 .7
Sirius	1	6	36	1	2 .65	16	26	35 S	+ 4 .3
δ Canis Majoris	2	6	59	59	2 .44	26	4	32 S	+ 5 .2
Castor	1.2	7	21	22	3 .85	32	19	30 N	— 6 .9
Procyon	1.2	7	28	27	3 .14	5	45	3 N	— 7 .5
Pollux	2.3	7	32	37	3 .69	28	30	42 N	— 7 .9
ζ Navis	2	7	56	19	2 .11	39	25	36 S	+ 9 .7
γ Navis	2	8	3	10	1 .85	46	43	54 S	+10 .3
Acubens	3	8	47	8	3 .30	12	39	6 N	—13 .4
β Navis	1	9	10	54	0 .75	68	52	2 S	+14 .8
Alphard	2	9	17	24	2 .93	7	46	7 S	+15 .2
Regulus	1	9	57	20	3 .20	12	58	21 N	—17 .2
η Navis	2	10	37	4	2 .30	58	36	3 S	+18 .7
β Ursæ Majoris	2	10	49	14	3 .71	57	29	17 N	—19 .1
Dubhe	2	10	50	49	3 .85	62	52	9 N	—19 .1
β Leonis	2	11	38	29	3 .06	15	43	47 N	—19 .9
γ Ursæ Majoris	2	11	46	51	3 .22	54	50	47 N	—20 .0
α Crucis	1	12	15	14	3 .24	61	57	6 S	+20 .0
γ Crucis	2	12	19	47	3 .24	55	57	2 S	+20 .0
β Crucis	2	12	35	46	3 .41	58	33	19 S	+19 .8
Aliath	2	12	44	51	2 .67	57	5	14 N	—19 .7
Spica Virginis	1	13	14	18	3 .13	10	4	31 S	+19 .0
ζ Ursæ Majoris	2	13	15	32	2 .43	56	0	41 N	—19 .0
Benetnach	2	13	39	23	2 .40	50	21	7 N	—18 .2
β Centauri	1.2	13	49	23	4 .11	59	21	49 S	+17 .8
Arcturus	1	14	6	13	2 .72	20	15	58 N	—19 .1
α Centauri	1	14	26	1	4 .45	59	58	44 S	+16 .1
Alphacca	2	15	25	55	2 .53	27	25	16 N	—12 .5
β Scorpii	2	15	53	26	3 .47	10	13	29 S	+10 .5
Antares	1	16	16	44	3 .64	25	57	22 S	+ 8 .7
Ras. Algethi	2	17	5	13	2 .73	14	38	18 N	— 4 .8
Ras. Alhague	2	17	25	20	2 .77	12	43	28 N	— 3 .0
Vega	1	18	29	56	2 .02	38	35	51 N	+ 2 .6
Altair	1.2	19	40	41	2 .92	8	19	48 N	+ 8 .5
Deneb	2	20	34	22	2 .03	44	32	51 N	+12 .5
α Gruis	2	21	55	6	3 .85	47	57	8 S	—17 .1
Fomalhaut	1	22	46	10	3 .33	30	42	51 S	—19 .0
Scheat	2	22	53	45	2 .87	26	57	41 N	+19 .2
Markab	2	22	54	27	2 .96	14	5	42 N	+19 .2
Andromedæ	2	23	57	43	3 .07	27	56	51 N	+20 .0

Navigation of the ancients. See Phœnicia and Trade.

Inland Navigation, the method of conveying commodities from one part of a country to another by means of rivers, lakes, canals, or arms of the fea, penetrating far into the internal parts. See the article Canal.

The advantages of this mode of conveyance, in an extenfive and populous country, are fufficiently obvious; whether we take into account the fuperior cheapnefs, facility, or quicknefs with which great quantities of goods can thus be carried from one place to another, or the advantages which may accrue to agriculture and other arts, by thus conveying manures, the produce of the ground, or heavy manufactured goods, to and from diftant quarters; which would be altogether impracticable by a land-carriage, without incurring a much greater expence than the commodities could bear. The good effects of inland navigation are particularly evident in the vaft empire of China, and in the ftates of Holland. In both thefe countries, the multitude of canals undoubtedly contributes to the opulence of the inhabitants, both by the more free fcope they give to trade, and the advantages derived from them to agriculture; not to mention, that by means of the canals themfelves the ground is often meliorated and made capable of producing both corn and pafture, where otherwife it would perhaps yield neither, or at leaft very imperfectly. Thefe countries, however, particularly Holland, are very flat, and thus very much fitted for this kind of navigation: Great Britain and Ireland are lefs fo, on account of the greater inequality of their furface; though in them alfo the making of canals is now become very common, notwithftanding the immenfe expence with which fuch undertakings are attended.

In a late treatife upon this fubject by Mr Edmund Leach furveyor, the author confiders the advantages which might accrue to the kingdoms of Britain and Ireland, were their inland navigation improved as much as it might be; and he confiders both countries as exceedingly proper for improvements of this kind on account of the number of fine ftreams of water they contain. "Every county (fays he) in each kingdom is furnifhed with rivers and ftreams of water; very few, if any, of which but may be made navigable to within a mile or two of their fources" by the method he propofes.

The method of making canals hitherto practifed, is fo fully defcribed under the article Canal, that nothing needs be faid upon it in this place. Mr Leach obferves, that all the artificial inland navigations made in this, as well as in other kingdoms, have been done by beginning them at the foot or mouth of a river, or at the utmoft extent of the ebb or flow of the tide; proceeding thence upwards, either in the ordinary courfe of the river by finking, widening, and cleanfing it; then with the affiftance of a lock and dam to raife the boats or other veffels to a higher level. This is next to be cut, widened, and cleanfed as before, till we come to a third level, when the veffels are to be raifed as in the former; proceeding thus, as it were ftep by ftep, till we arrive at the extent of the intended navigation. Otherwife the navigation is carried on by an artificial fide-cut or canal near the courfe of the river, raifed up by locks and dams as before. Thefe methods, however, tho' probably of very great fervice to the country, are attended with many and confiderable inconveniences.

1. Every river or other ftream is the natural receptacle of all the fprings, rains, and floods, which difcharge themfelves into it; by which means it fometimes difcharges fuch torrents of water as fweep every thing away before them. This not only interrupts the navigation for a time, but is often attended with the moft intolerable expence.

2. The original making of the canal with a number of locks and dams, fuch as is defcribed under the article Canal, muft alfo be very expenfive.

3. Some rivers run very rapidly in particular places; and if the defcent of the bed be very great, it will require a number of the locks and dams already mentioned to make fuch a river navigable, though the navigation fhould extend but a few miles from the mouth.

4. The paffing of the locks is always attended with a confiderable difficulty, befides the lofs of time and expence.

To obviate all thefe inconveniences, Mr Leach propofes to begin and carry on his canal in a manner precifely the reverfe of that juft now defcribed. In his method, the canal is to be begun as near the fource of the river as poffible; that is, as near as there is a probability of having water in the drieft feafons fufficient to fill the canal; of which there can be but little required, as a ftream fufficient to turn an ordinary mill muft be fufficient to anfwer all the purpofes of fuch a canal. Thus the navigation may be carried up much higher than in the ordinary canals with dams and locks. If a canal be made properly, and the fides and bottom plaftered with a cement that may be made of the fame earth and clay faved in making the trunk, very little water will be requifite to keep it full. Our author fuppofes that a ftream fufficient to turn an ordinary mill will be fufficient to keep it full, even if the canal fhould be 20 miles long.

To conftruct a canal of this kind, we muft make choice of a level as near the head of the river as poffible; this level muft be continued for a confiderable way, fo that the water may not have the leaft current, but may abfolutely ftagnate. Thus the original bed of the river will foon be left at a diftance, and the ftagnant canal will become higher and higher with refpect to it, in proportion to the defcent of the ground or rapidity of the river. Having proceeded this way as far as convenient, the veffels muft be let down by a machine (to be afterwards defcribed) into the bed of the original river, or from one elevated canal to another much lower; perhaps 10, 15, or 20 fathoms.

By this perfect ftagnation of the water in the canals, there will be no danger of wafhing off the plaftering from the fides and bottom, fo that the only wafte of water will be by evaporation, and what is required for working the machine above mentioned; which, as it is only required at particular times when veffels are to be raifed or lowered, muft be very trifling, and cannot bear any proportion to the conftant fupply at the head of the canal.

In order to keep the firft level eafily, and for a confiderable way, it will be neceffary to avoid the many valleys which are naturally to be met with near the original river, by the defcent of other ftreams into it.

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Hence canals constructed on the plan recommended by our author must run out in serpentine windings a considerable way into the country, which will augment its length greatly beyond that of the original river; and thus a much greater number of people, and larger extent of country, will reap the benefit of it than if it was continued in a straight line. "One inconvenience (says our author) attending the old inland navigations that are carried on in or nigh the original rivers, is their being confined within too small a space of land, and where, for the most part, there is the least occasion either for water to water the land, or for manure to enrich the soil; whereas, by beginning a canal near the head of a river, and by continuing it on one common level, if the river have any thing of a descent, and runs pretty rapid, the original river and its valley is soon left, and the canal is removed up into the side of the hill, where there is generally most occasion for manure and water both; and the further on it is continued, and the more rapid the river runs, the further the navigation is removed from the valley and the original course of the river, till it is brought to the place designed for the purpose of transferring the vessels down at once by a machine into the original river, the sea, or into another canal."

Notwithstanding the advantages which attend this new mode of construction, our author acknowledges that there are some cases in which the old method only can be put in practice.

With regard to the size, form, and expence of canals of this kind, Mr Leach gives a computation from one which was intended to be made in the county of Cornwall, and which was called the *Tamar* canal. An act of parliament was obtained for this in 1774. A navigable canal was to be made from Bude Haven, in the county of Cornwall, on the Bristol Channel, to the navigable part of the river Tamar; the design being to open a communication between the English and Bristol Channels through the counties of Devon and Cornwall. By the act, it was determined that the canal should not exceed 63 feet in breadth, nor should the ground be cut more than 39 inches deep below the surface, excepting in places where docks or basons were to be made, or where cranes or other engines were to be erected for particular purposes. The breadth allowed (63 feet) was to comprehend the water itself, the two towing paths, one on each side, and the fences beyond them. The breadth of the canal itself was to be 21 feet at the surface and 12 at bottom; the depth on the under side, 39 inches, as already said; the towing paths 12 feet broad each; and beyond these an hedge or rail at the distance of six feet on each side from the paths. There were to be drains as usual in canals; one on the under side for carrying off the superfluous water from the canal; the other on the upper side for carrying off the water which might accidentally fall into it in rains, or by springs in the higher grounds. Thus the whole would not exceed the breadth proposed by act of parliament; while the canal itself would be sufficiently large for every necessary purpose. Mr Leach computes, that on this canal two boats, carrying 10 tons each, might very easily pass: and he recommends this as the proper size of canals in other parts of the kingdom.

Canals of this kind, our author observes, will, for the most part, be made in the side of an hill or rising ground; whence the greatest part of the earth dug out of it will be thrown upon the under side. Here it will elevate the ground sufficiently to form a towing path, together with an elevated space whereon to plant the hedge or fence. On the higher side, 12 feet of the ground must be cut down to within 18 inches of the surface of the water; and the earth and stones dug out in making this path will make the fence on the outside for keeping off the cattle. As by the act of parliament, however, there is a greater breadth allowed in some places for making docks or basons, our author calculates the whole breadth of the canal at 66 feet; and according to this breadth he makes his computations.

1. The first and principal expence is the digging of the trunk of the canal; but this must vary so much according to the nature of the ground, that no certain estimate of the expence can be made. Sometimes the ground may be soft, and easily cut, sometimes hard and rocky, sometimes marshy and boggy, &c. There must also be a very considerable difference in the expence of cutting the canal, according as the ground on one side of it is more or less elevated. Mr Leach, after making the proper calculations, supposes that in every perch of a canal of the kind under consideration there must be removed $40\frac{1}{7}$ cubical yards, or 1085 cubical feet, of earth. Agreements with the workmen are commonly made by the cubic yard. It is rare that a cubic yard can be removed for less than 2d. "nor (says our author) will any sort of ground require more than 9d. except in passing through a rock, which will not often happen, unless where, by the situation of the land through which the canal may pass, it should require to be cut more than four feet under the surface, as it may sometimes happen in cutting through a hill or neck of land, whereby the course of the canal may be shortened. According to this estimate, Mr Leach has formed a table of the expence of making canals from 2d. the cubic yard to 9d. The smallest expence of these per mile is L. 107 : 11 : $1\frac{1}{2}$; the greatest L. 483 : 19 : 9. Sometimes, however, the expence may be even greater; so that the mile may cost L. 600, or near it; but this must be accounted an extraordinary expence, and not often to be expected.

In digging the trunk of the canal, care must be taken to preserve all the sand, stones, and gravel, for the purpose of making drains or gutters and the towing paths; also for the making of a wall, the outside face of which is to be 21 feet distant from the edge of the canal. The design of this is to prevent the earth and rubbish from being thrown to too great a distance from the side of the canal; and likewise for the purpose of raising a bank on the lower side about 16 or 18 inches above the surface of the water in the canal, when it is full up to the drains. On the top of this bank the towing path is to be made 12 feet wide on that side of the canal; and if this wall should be raised four feet above the surface of the towing path, it would be a fence to keep the cattle off from that side. In making the towing path on the higher side, the surface of the land must be sunk to within 16 or 18 inches of the surface of the water in the canal when full; and the turf, earth, stones,

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ftones, &c. taken from thence in making the towing path on that fide, will make the other fence of the canal.

2. Drains or gutters muft be made under the towing paths, on both fides of the canal. On the upper fide they muft be made through the hedge or fence at all convenient places, for admitting fprings and rivulets, as well as rain-water into the canal. On the higher fide, thefe fhould be about 132 feet diftant from one another, exclufive of thofe for the admiffion of fprings. On the lower fide, it is neceffary to have drains at the diftance of 66 feet from each other; which will be 80 drains per mile. Thefe may be conftructed for 2s. 6d. each, which amounts to L. 10 per mile. On the higher fide they will coft about four fhillings per drain; and, at the diftance of 132 feet betwixt each drain, the expence will be L 8 per mile.

In making the drains on the lower fide, great care muft be taken to have them truly level, and parallel to the horizon; the bottom part of the drain being exactly 39 inches perpendicular above the bottom of the canal; as on the true placing of thefe drains, and the true level of the bottom of the canal, entirely depends the regularity of the deepnefs of the water.

3. The value of the ground through which the canal is to pafs muft alfo be confidered. From the obfervations and memorandums which our author took in the year 1774, concerning the ground through which the Tamar canal was to pafs, he concluded that one eighth part of the land through which the tract paffed was worth 40s. per acre; another eighth, 20s.; a third eighth part, 10s.; and all the reft not worth more than five; and a great deal of it not more than two; the average of the whole being 15s an acre. "Then (fays he), if the good, indifferent, and bad land be worth on an average, 15s. an acre, and as 30 years value is a capital price for lands, it will, at that rate, amount to 22l. 10s. per acre. The ftipulated breadth of the canal with the towing paths and hedges being, as already faid, 66 feet, which is exactly a gunter's chain; then, 10 fuch chains in length and one in breadth form exactly a ftatute acre of land; and ten chains in length is a furlong; fo that every mile of canal will thus take up eight acres of land, which, at 22l. 10s. per acre, amounts to 180l. per mile.

4. Bridges are likewife a confiderable article of expence in the making of canals. Mr Leach fuppofes that there may be one common road bridge and two fwivel bridges required per mile; the former may be erected for 60l. and the latter for 30l. each; fo that the expence of all together will amount to 120l. per mile.

5. As in fome particular places, on account of fhort turns, and where docks and bafons and landing places are to be made, a greater widenefs will be required, our author allows half an acre more land for every furlong on this account; which brings an additional expence of 90l. per mile.

6. It will always be neceffary to have fluices for emptying the canal; each of which will coft 20l. Mr Leach allows a fluice and ftop-gate for every mile; and as thefe coft 20l. each, we have thus a farther expence of 40l. per mile.

7. The wall on the lower fide againft the bank of earth and towing path may be built for three fhillings per perch; and as every mile contains 320 perches, the expence of the wall will be 48l. per mile.

8. Our author calculates the towing path on the lower fide at the fame price; fo that it alfo makes an addition of 48l. per mile; but as he eftimates the higher towing path and hedge at 8s. per mile, this will amount to 128l. per mile.

Thus, according to our author's calculation, the whole expence of making a canal with its neceffary appendages will amount to L. 944 : 13 : $1\frac{1}{2}$ per mile; and by the calculation of another engineer, the particulars of which he alfo enumerates, it would not exceed L. 1032 : 13 : $4\frac{1}{2}$. This our author thinks a moderate expence; but an objection naturally occurs from the great length to which fuch canals muft neceffarily run; a remarkable inftance of which he gives in the propofed Tamar canal; where, though the diftance betwixt Bude Haven and the navigable part of the river Tamar is no more than 28 miles in a ftraight line, the length of the canal would not have been lefs than 80 miles. This length, however, according to our author, "ought not to be an object of difcouragement, but on the contrary an inducement and an encouragement to promote the extending of it as much as poffible into the country, as it will bring a market to every man's door that it draws nigh in its paffage, and be a means to improve a greater quantity of uncultivated lands; and the navigation will be thereby much more extenfive, and a much larger number of inhabitants will reap the advantages thereof, than if it had been carried on upon the original river."

We have already taken notice, that in the method of conftructing canals juft now mentioned, there will at certain intervals be places where the veffels muft be raifed and lowered by means of mechanical powers, inftead of the dams and locks made ufe of in other canals. Thefe machines are compounded of an inclined plane and wheel in axis. The inclined plane is a parallelogram whofe length reaches from the end of one canal to the beginning of another, or to the fea or navigable river, to which the veffel is next to be conveyed; the breadth ought to be $22\frac{1}{2}$ feet. It may be made of good oak or deal plank, and fufficiently ftrong to bear the weight to be laid upon it; and it muft be very ftrongly fupported by beams of oak or other wood. It ought to be divided in the middle by a ledge or rib of 12 inches fquare, the fide ribs being nine by 12 inches. The elevation muft depend upon particular circumftances. Fig. 1. fhows the inclined part of the machine; AB being the wooden part juft defcribed, placed between the fide of the hill W and the navigable river F. According to the dimenfions already given, the two paths A and B on which the veffels move are exactly ten feet wide. G reprefents the canal, brought perhaps from the diftance of feveral miles to the top of the precipice WW. At the end of the canal, and quite acrofs from R to R, muft be built a very ftrong wall; in which are two fluices with flood-gates at K and L, to let out the water occafionally. Between the head of the plane AB, and the end of the canal G, is a horizontal platform divided into two parts, as is reprefented in the figure by the letters HI. At the end of the canal are fix

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 rollers

Inland Navigation.

rollers M and N, of ufe in carrying the boats and lighters in and out of the canal. Near the end of the canal, at S and T, are two other fluices, with their flood-gates, for letting out a quantity of fluid to drive the other part of the machine. O and P reprefent the two ends of the towing paths, one on each fide of the canal.

Plate CCCXLIV

Fig. 2. fhows the vehicle by which the lighters are conveyed up and down the inclined plane, by the two paths A and B, fig. 1. AA (fig. 2.) reprefents part of the inclined plane, B the vehicle in the pofition in which it rolls up and down the two paths. C is the body of the vehicle, which is made hollow, to contain a quantity of water occafionally ufed as a counterbalance for its correfponding vehicle. DDD are three rollers between the bottom of the vehicle and the plane, for the purpofe of rolling the boats up and down. HHH are fix rollers; four on the horizontal part of the vehicle on which the boat E is to reft in its paffage up and down the plane; the other two rollers are in a moveable part, which is faftened to the body of the vehicle with a pair of very ftrong hinges; and in the paffage of the vehicle up and down the plane it turns up between the head of the boat and the plane, preventing the former from rubbing againft the plane. When the vehicle gets up to the top, this moveable part falls down on the platform marked HI, becoming parallel with the horizontal part of the vehicle; after which it ferves as a launch and paffage to place the boat upon the rollers MN (fig. 1.) at the end of the canal. This paffage part of the vehicle, together with the three rollers at the end of the canal, is likewife of great ufe in towing a boat out of the canal, in order to place it on the horizontal part. At the bottom of the cavity of the vehicle is a large hole F, with a valve opening inwardly. Through this hole the water enters when the vehicle finks into the navigable river F, for the purpofe of receiving a boat on the top or horizontal part of the vehicle, till it is quite full; and will then fink entirely under water, while the boat is towed in on the horizontal part. A fmall rope K is faftened to the valve, on purpofe to lift it up, and to keep it fo while the vehicle and boat are afcending up the plane out of the canal, that fo the water may difcharge itfelf till as much as is neceffary be got out; or till it becomes an equal balance for the correfponding vehicle and its contents, which are defcending by the other path. Hence we fee, that every machine muft have two of thefe vehicles furnifhed with rollers as already defcribed, and fo conftructed that one may be as nearly as poffible a counterbalance to the other. As it is neceffary that the vehicles fhould be water tight, the infides of them muft be caulked very tight; and they fhould be capacious enough to hold as much water as will balance the largeft boat with its contents. Here it may be obferved, that every veffel will be balanced by as many cubic feet of water as it difplaces by being put into the water when loaded. The quantity may eafily be known, by obferving how far the boat finks in the water, and calculating the bulk of the part immerfed.

The machine which puts the vehicles in motion, may either be conftructed with an under-fhot or breaft-water-wheel; by an over-fhot water-wheel; or by two walking-wheels, for men to walk in as in cranes, &c.

Fig. 3. fhows a front view of the under-fhot water-wheel movement; where A is the end of the axis or cylinder of the cog or fpur-wheel; the diameter of which axis is four feet, and its length not lefs than 22 feet, as it muft be extended quite acrofs the canal from one fide to the other, and placed on the top of very ftrong fupporters on each fide of the canal, about feven feet above the furface of the water, as the loaded boat is to pafs backwards and forwards under the cylinder, and at a convenient diftance from the wall RR (fig. 1.) and placed between the two fluices S and T; on the end of which cylinder is the cog-wheel B (fig. 3.) The wheel B is fuppofed to be 20 feet in diameter, having on its edge 120 cogs; and underneath the cog-wheel is the breaft-water one C, 24 feet in diameter from the tip of one aller-board to the tip of its oppofite. On the end of the axis of the water-wheel D is a trundle two feet and an half in diameter, with 15 rounds or ftaves contained therein. This muft be placed between the two fluices S and T, to let the water out of the canal; which, falling on the float-boards, will turn the wheel round from the right hand towards the left, when the fluice on the left hand of the wheel is opened; but the contrary way when that on the right is opened.—The water falling upon the boards paffes along with the wheel in the circular cavity EGF, and is difcharged at G, whatever way the wheel may turn.

To the axis or cylinder of this machine, which muft always be horizontal, are fixed two pair of ftrong ropes; the ends of each pair faftened to the upper part of the cylinder; it being neceffary that they fhould act in contrary directions. Each muft extend the whole length of the plane, and their ftrength muft be proportioned to the weight neceffary to be fuftained. The two vehicles already mentioned are faftened to the other ends of the ropes; fo that one pair of the ropes are wound up by the cylinder turning one way, and the other by its turning the contrary way. Thus, when one of the vehicles is at the upper part of the path A, ready to difcharge its boat and cargo into the upper canal, the other boat will be at the foot of the path B, all under water in the lower canal, and ready for the reception of a boat to be towed in on the horizontal part of it; fo that as one vehicle rolls up on one fide of the plane, the other will roll down on the other fide, and *vice verfa*.

Fig. 3.

Fig. 4. fhows the movement by means of an over-fhot water-wheel. It confifts of a water-wheel C, and two fpur or cog-wheels A and B. The water-wheel is 18 feet in diameter, and has two rows of buckets placed contrariwife to one another, that it may turn round in contrary directions, according as the one or the other fluice, S or T, is opened. On its axis F is a trundle of three feet diameter, having 18 rounds or ftaves which fall into the cogs of the fecond fpur-wheel B, caufing it to turn round in a direction contrary to that of the water-wheel. This fecond wheel is likewife 18 feet in diameter, with a trundle of three feet, having 18 rounds or ftaves.—The diameter of the upper fpur-wheel A is alfo 18 feet, but the diameter of its axis is fix feet. On the edge of the wheel are 108 cogs. Thefe fall in between the ftaves of the axis of the other fpur-wheel; and thus the third wheel turns round the fame way with the water-wheel C. The cylinder of this upper fpur-wheel

wheel muſt be placed acroſs the canal betwixt the two ſluices, on very ſtrong ſupporters, as explained in the former movement, and the two pair of ropes in the ſame manner.

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The movement of the walking-wheel is ſhown (fig. 5.) A1 and A2 are two wheels for men to walk in, each of them 24 feet in diameter. B1 and B2 are the axes or cylinders of the two wheels, of equal lengths; viz. 11 feet each, and four in diameter.—At one end of each of the two cylinders C1 and C2, is a wheel of the ſame diameter with the cylinder. On the edges of theſe wheels are teeth of an equal number in each wheel; and as the teeth of the wheels mutually fall into each other, the revolutions of both muſt be performed in the ſame time. By this contrivance alſo the cylinders will turn different ways; and the ropes on the two different cylinders will conſtantly one pair be wound up, and the other wound down, by the natural moving of the machine. DDD is the frame that ſupports the whole, which muſt be made very firm and ſecure.

Let us now ſuppoſe, that there is a boat in the upper canal to be brought down, but none to go up for a balance. In this caſe, as one of the vehicles muſt be at the top to receive the boat, the other will be at the bottom to take in water. Let then any of the movements juſt deſcribed be ſet to work, and it is plain, that as the upper vehicle with its boat deſcends, the under vehicle will aſcend with the water; the valve being in the mean time lifted up till a ſufficient quantity of water has flowed out, to make the one nearly a counterbalance to the other; ſo that the veſſel may ſlide down gently and without any violence.

If it happens that a boat is to go up while none is to come down, one of the vehicles being at the foot of the plane under water, and in readineſs to have the boat towed upon its horizontal part, one of the ſluices at K or L is to be opened, and a quantity of water let into the ciſtern of the upper vehicle ſufficient to counterbalance the boat with its contents which is to aſcend. This being done, the machine is ſet to work, the valve of the under vehicle kept open till the water is all diſcharged; and then the boat will roll up to the top of the plane.

From this deſcription of the canal and machinery for raiſing and lowering the veſſels, the reader can be at no loſs to underſtand the principles on which it depends. It would be ſuperfluous to adduce examples, or follow our author through his calculations relative to particular caſes. We ſhall only obſerve, that the difference of time in which veſſels may be raiſed or lowered by the machinery juſt deſcribed, in compariſon with what can be done in the common way by dams and locks, muſt give a very favourable idea of the new method. According to Mr Leach's computations, a boat with its cargo weighing 10 ton might be raiſed by the walking-machine in 12 or 14 minutes, by the underſhot-wheel in 15 minutes, and by the overſhot-wheel in 30 minutes; and that through a ſpace of no leſs than 30 fathoms meaſured on the inclined plane, or 114 feet perpendicular.

NAULUM, a piece of money put into the mouth of a perſon deceaſed among the Romans, to enable him to pay Charon the ferryman for his paſſage. It was to be of the current coin of the reigning emperor: from this money then the time of the perſon's death may be known. The ſum for poor men was a farthing, but the rich in general were very liberal to the old tar Charon, as appears from the number of coins often found in the neighbourhood of Rome on opening the graves of great men. Charon was looked upon as a very moroſe and obſtinate old fellow, who would not carry over any man without his fare: and hence the proverbial uſe of that verſe in Juvenal,

Furor eſt poſt omnia perdere naulum.

A ſimilar cuſtom took place among the Greeks; but the money put into the mouth of the deceaſed was called Δανακη.

NAUMACHIA, in antiquity, a ſhow or ſpectacle among the ancient Romans, repreſenting a ſea-fight. Theſe mock ſea-fights are ſuppoſed to have originated at the time of the firſt Punic war, when the Romans firſt inſtructed their men in the knowledge of naval affairs. Afterwards they were intended to entertain the populace, as well as to improve the ſeamen. They were often like other ſhows exhibited at the expence of individuals, to increaſe their popularity.

In theſe ſpectacles they ſometimes ſtrove to excel each other in ſwiftneſs; and ſometimes engaged in a warlike manner. The Naumachiæ of Claudius indeed was a moſt ſavage diverſion. The combatants uſed to deſtroy each other to amuſe a tyrant and a cruel mob. As they paſſed before him, they uſed this melancholy greeting, "*Ave Imperator, morituri te ſalutant.*" The emperor replied, "*Avete vos.*" This they underſtood as an anſwer of kindneſs, and a grant of their lives; but they ſoon diſcovered that it proceeded from wanton cruelty, and barbarous inſenſibility. In the time of the emperor Domitian, ſuch a vaſt number of veſſels engaged as would have nearly formed two regular fleets for a real fight, and the channel of water was equal in magnitude to a natural river. The emperor Heliogabalus is reported to have filled the channel where the veſſels were to ride with wine inſtead of water. Tritons and ſea-monſters were frequently exhibited during the engagement. Suetonius and Dio Caſſius inform us, that at one of theſe ſea-fights of Domitian a violent ſhower fell; the emperor, however, continued till the end of the engagement, often changing his clothes, nor would he ſuffer any one to depart; and as the rain continued for ſeveral hours, many were ſeized with diſtempers, and ſome even died, Suet. cap. 4. Dio, lib. lxvii. Naumachiæ were alſo places fitted up for theſe ſhows, a ſort of circus's or amphitheatres, with ſeats and porticos, &c.: there were ſeveral of them at Rome; three built by Auguſtus, one by Claudius, another by Domitian, and another by Nero; which ſerved for the reverſe of his medals. Claudius uſed the lake Fucinus as a Naumachia.

NAUMBURG, a town of Germany, in the circle of Upper Saxony, capital of the county of Saxe-Naumburg, ſituated on the river Sala, in E. Long. 11. 20. N. Lat. 51. 12.

NAUPACTUS, or NAUPACTUM, (anc. geog.) a city of Ætolia, at the mouth of the Evenus. The word is derived from ναυς and πηγνυμι, becauſe it was there that the Heraclidæ built the firſt ſhip which carried them to Peloponneſus. It firſt belonged to the Locri Ozolæ, and afterwards fell into the hands of the Athenians, who gave it to the Meſſenians, who

had been driven from Peloponnefus by the Lacedemonians. It became the property of the Lacedæmonians after the battle of Ægofpotamos, and it was reftored to the Locri. Philip of Macedonia afterwards took it, and gave it to the Ætolians; from which circumftance it has generally been called one of the chief cities of their country. E. Long. 22. 20. N. Lat. 38. 0.

There was on the fhore a temple of Neptune, and near it a cave filled with offerings, and dedicated to Venus, where widows reforted to requeft new hufbands of the goddefs. Paufan. lib. 10. p. 898.

NAUPLIA, (anc geog.), a maritime city of Peloponnefus. It was the naval ftation of the Argives. The fountain Canathos was in its neighbourhood.

NAUPLIUS, (fab. hift.), a fon of Neptune and Amymone, king of Eubœa. He was the father of the famous Palamedes, who was fo unjuftly facrificed to the artifice and refentment of Ulyffes by the Greeks at the Trojan war. The death of Palamedes highly enraged Nauplius; and to revenge the injuftice of the Grecian princes, he endeavoured to debauch their wives, and ruin their characters. When the Greeks returned from the Trojan war, Nauplius was pleafed to fee them diftreffed in a ftorm on the coafts of Eubœa; and to make their difafter ftill more univerfal, he lighted fires on fuch places as were furrounded with the moft dangerous rocks, that the fleet might be fhipwrecked upon the coaft. This had the defired effect; but Nauplius was fo difappointed when he faw Ulyffes and Diomedes efcape from the general diftrefs, that he threw himfelf into the fea. According to fome mythologifts there were two perfons of this name, a native of Argos, who went to Colchis with Jafon. He was fon of Neptune and Amymone.—The other was king of Eubœa, and lived about the time of the Trojan war. He was, as fome obferve, fon of Clytonas, one of the defcendants of Nauplius the Argonaut. The Argonaut was remarkable for his knowledge of fea affairs and of aftronomy. He built the town of Nauplia, and fold Auge daughter of Aleus to king Teuthras, to fcreen her from her father's refentment.

NAUPORTUS, or NAUPORTUM, (anc. geog.), a town on a cognominal river, towards its fource, in Pannonia Superior. The reafon of the name, according to Pliny, is, that the fhip Argo, after coming up the Danube, the Save, and the Laubach, was thence carried on mens fhoulders over the Alps into the Adriatic. The river Nauportus rifes in the Alps, near Longaticum, at the diftance of fix miles from the town Nauportum; which was a colony of the Taurifci, a people on the confines of Noricum. Now *Upper Laubach* in Carinthia, on the river Laubach. E. Long. 14. 40. N. Lat. 46. 28.

NAUSCOPY, the art of difcovering the approach of fhips or the neighbourhood of land at a confiderable diftance. This pretended art was invented by a M. Bottineau, employed in the King and Company's fervice in the ifland of France, from the year 1782 to 1784; and the account of it is given by the inventor as follows:

"This knowledge is not derived either from the undulation of the waves, or from the fubtilty of fight, nor from any particular fenfation; but merely from obfervation of the *horizon*, which difcovers figns indicating the proximity of fhips or of land.

"On the *approximation* of a fhip towards the land, or towards another fhip, there appears in the atmofphere a *meteor* of a particular nature, vifible to every one without any *painful attention*. It is not by any kind of accident that this meteor appears under thefe circumftances; on the contrary, it is the neceffary refult of the approximation of one veffel towards another, or towards the land. The exiftence of the *meteor*, and the knowledge of its different modifications, are what conftitute the certainty and the precifion of my informations.

"If I am afked, how it is poffible that the approach of a fhip towards land fhould give birth to any *meteor* whatfoever in the atmofphere, and what connection there can be between two objects at fuch a diftance from each other? I reply, that I am not obliged to give an account of the *hows* and the *wherefores*; that it is fufficient for me to have difcovered the fact, without being obliged to account for its principle."

The writer concludes, by defiring to be called on for experimental proofs, and by promifing in future a complete treatife of Naufcopy, with maps, plates, &c.

This complete treatife, as far as we know, has not yet been publifhed, nor do we expect ever to fee fuch a treatife on the fubject as will fatisfy the minds of thofe who are perfuaded that every effect muft have an adequate caufe. The adminiftrators of the ifland, who gave to M. Bottineau what he calls a *report*, containing the moft authentic and moft explicit teftimony of the reality of the difcovery, feem to be of our opinion; and yet they fpeak of this difcovery with doubt, and with a degree of refpect to which we think it can lay no claim. Their report is in the form of a letter directed to the *Marechal de Caftries*: and that our infidelity may not deprive the public of what, in the immenfe catalogue of poffibilities, *may* lead to a ufeful difcovery, we fhall here fubjoin a copy of it.

Port Louis, Ifland of France, the 18th February 1784.

"My Lord, A letter which you have written on the 6th of April to M. Bottineau, employed in the King and Company's fervice in this colony, obliges us not to refufe him one for you, of which he propofes being himfelf the bearer. The defire only of being ufeful to his country, is (as he fays) the motive which determines him to take this ftep. He would be angry with himfelf were he to conceal a difcovery which hath hitherto efcaped the moft enlightened perfons, and of which he only is in poffeffion. This difcovery is the art of announcing the prefence of one or feveral fhips, at 100, 150, and as far as 200 leagues diftance. This is by no means the refult of his ftudies, nor the fortunate application of the principles of any particular fcience; his fcience is in his eyes only, and he can have no other: what we call *penetration* and *genius* cannot make up to him what he is deficient in from education. He perceives (as he fays) in nature, fome figns which indicate to him the prefence of the veffels, as we know that there is a fire in a place when we perceive the fmoke which comes from it. This is the comparifon which he makes ufe of himfelf to thofe who have converfed with him about his art: this (though he has kept his fecret to himfelf)

felf) is the plaineft thing he has faid, in order to make it be underftood that he hath not made this difcovery by the knowledge of any art or fcience, which had been the object of his application, or of his former ftudies.

"It is according to him the effect of chance; he hath taken nature in the act, and hath difcovered his fecret; fo that his fcience, or rather the firft elements of it, hath not coft him the leaft trouble: but the thing which hath coft him a great deal of labour, and which may be really called his own, is the art of judging of the exact diftance.

"According to him, the figns very clearly indicate the prefence of fhips; but none but thofe who can well read thefe figns can draw any conclufions from them with regard to diftances; and this art of reading them well, is, according to him, a true and a very laborious ftudy: for this reafon he hath himfelf, for a very long time, been the dupe of his fcience. It is at leaft 15 years fince he firft foretold here the arrival of fhips. At firft this was regarded only as a frolic. Wagers were laid on both fides. He often loft, becaufe the fhips did not arrive at the time prefcribed by him. From thence came his application to find out the caufe of thefe miftakes; and the perfection of his art is the refult of this application.

"Since the war, his informations have greatly increafed, and probably were fufficiently exact to excite the attention of the public. The noife of them reached us with the degree of enthufiafm which is always excited by the marvellous. He himfelf fpoke of the reality of his fcience with the tone of a man convinced. It would have been too cruel to have difmiffed him as a vifionary.

"Befides, every thing depended upon proofs, and we required that he fhould produce fome: in confequence, he hath regularly fent us, for eight months, the informations which he thought he might venture to fend us; and the refult is, that feveral of the fhips he announced are arrived at the time he foretold, after feveral days of information.

"Others have come later than was expected, and fome have not appeared at all.

"With regard to fome of thefe, it hath been afcertained, that their delay had been occafioned by calms or by currents. M. Bottineau is perfuaded, that thofe which never appeared were foreign veffels which went on; and accordingly we have learned, that fome Englifh fhips were arrived in India, which might perhaps have been in fight of the ifland at the time indicated. But this is no more than a conjecture, which our occupations have not allowed us to inveftigate What we can afcertain is, that in general it appears that M. Bottineau hath made juft obfervations: whether it is owing to chance or to his abilities, it might be, perhaps, imprudent to determine. It is however certain, that the fact is fo extraordinary, under whatever light it is confidered, that we have not thought ourfelves able either to affirm or deny it; and we have wifhed the Sieur Bottineau to compel us to take one or the other fide of the queftion, by trufting his fecret to fome trufty and able perfon.—But this he hath refufed, being probably afraid that he fhould not acquire by the difcovery all the benefit which he imagines he may reap from it.

"Suppofing the reality of the difcovery, we do not believe that its utility can be as important as M. Bottineau perfuades himfelf it is; but it might perhaps throw a great light upon natural hiftory. In order to be ufeful, it would be neceffary that the difcovery fhould be confined to one nation, and remain unknown to all others. This will be impoffible, if every fleet, every veffel, and every privateer, is obliged to carry a man on board who is in poffeffion of this fecret.—We remain, with refpect, my Lord, your's, &c. Le V[te]. de Souillac, Chevreau."

NAUSEA, or SICKNESS; a retching or propenfity and endeavour to vomit, arifing from fomething which irritates the ftomach.

NAUTILUS, in zoology; a genus belonging to the order of vermes teftacea. The fhell confifts of one fpiral valve, divided into feveral apartments by partitions. There are 17 fpecies, chiefly diftinguifhed by particularities in their fhells.

Bonani obferves, that this genus of fhell-fifh is very well named from the Greek ναυτιλος, which fignifies both "a fhip" and "a failor;" for that the fhells of all the nautili carry the appearance of a fhip with a very high poop. Different authors, both ancient and modern, have called the nautilus by the names of *pompilus, nauplius, nauticus, ovum polypi, polypus teftaceus:* and the French call it *le voilier*. It is by fome imagined, that men firft learned the art of navigation from this animal.

The moft remarkable divifion of the nautili is into the thin and thick-fhelled kinds. The firft is called *nautilus papyraceus;* and its fhell is indeed no thicker than a piece of paper when out of the water. This fpecies is not at all faftened to its fhell; but there is an opinion, as old as the days of Pliny, that this creature creeps out of its fhell, and goes on fhore to feed. When this fpecies is to fail, it expands two of its arms on high, and between thefe fupports a membrane, which it throws out on this occafion: this ferves for its fail, and the two other arms it hangs out of its fhell, to ferve occafionally either as oars or as a fteerage; but this laft office is generally ferved by the tail. When the fea is calm, it is frequent to fee numbers of thefe creatures diverting themfelves in this manner: but as foon as a ftorm rifes, or any thing gives them difturbance, they draw in their legs, and take in as much water as makes them fpecifically heavier than that in which they float; and then they fink to the bottom. When they rife again, they void this water by a number of holes, of which their legs are full. The other nautilus, whofe fhell is thick, never quits that habitation. This fhell is divided into 40 or more partitions, which grow fmaller and fmaller as they approach the extremity or centre of the fhell: between every one of thefe cells and the adjoining ones there is a communication by means of a hole in the centre of every one of the partitions. Through this hole there runs a pipe of the whole length of the fhell. It is fuppofed by many, that by means of this pipe the fifh occafionally paffes from one cell to another; but this feems by no means probable, as the fifh muft undoubtedly be crufhed to death by paffing through it. It is much more likely that the fifh always occupies the largeft chamber in its fhell; that is, that it lives in the cavity between the mouth and the firft partition,

tion, and that it never removes out of this; but that all the apparatus of cells, and a pipe of communication which we so much admire, serves only to admit occasionally air or water into the shell, in such proportion as may serve the creature in its intentions of swimming.

Some authors call this shell the *concha margaritifera:* but this can be only on account of the fine colour on its inside, which is more beautiful than any other mother-of-pearl; for it has not been observed that this species of fish ever produced pearls. It must be observed, that the polypus is by no means to be confounded with the paper-shelled nautilus, notwithstanding the great resemblance in the arms and body of the inclosed fish; nor is the cornu ammonis, so frequently found fossile, to be confounded with the thick-shelled nautilus, though the concamerations and general structure of the shell are alike in both; for there are great and essential differences between all these genera. There is a pretty copious and minute account of this curious animal in the Gentleman's Magazine, vol. xxii. p. 6. 7. 8. and 301. and vol. xxv. p. 128.

NAVY, the fleet or shipping of a prince or state. See Marine.

The management of the British navy-royal under the lord high admiral of Great Britain, is entrusted to principal officers and commissioners of the navy, who hold their places by patent. The principal officers of the navy are four, viz. the treasurer, whose business it is to receive money out of the exchequer, and to pay all the charges of the navy, by warrant from the principal officers: comptroller, who attends and controuls all payment of wages, is to know the rates of stores, to examine and audit all accounts, &c.: surveyor, who is to know the states of all stores, and see wants supplied; to estimate repairs, charge boatswains, &c. with what stores they receive, and at the end of each voyage to state and audit accounts: clerk of the acts, whose business it is to record all orders, contracts, bills, warrants, &c.

The commissioners of the navy are five: the first executes that part of the comptroller's duty which relates to the comptrolling the victualler's accounts; the second, another part of the said comptroller's duty relating to the account of the storekeepers of the yard; the third has the direction of the navy at the port of Portsmouth; the fourth has the same at Chatham; and the fifth at Plymouth. There are also other commissioners at large, the number more or less according to the exigencies of public affairs; and since the increase of the royal navy, these have several clerks under them, with salaries allowed by the king.

The victualling of the royal navy hath formerly been undertaken by contract; but is now managed by commissioners, who hold their office on Tower-hill, London. The navy-office is where the whole business concerning the navy is managed by the principal officers and commissioners.

The royal navy of Great Britain is now in a very flourishing state, having been diligently kept up in late reigns, as the natural strength of the kingdom. When it is complete, it is divided into three squadrons, distinguished by the colours of the flags carried by the respective admirals belonging to the same, viz. *red, white,* and *blue;* the principal commander of which bears the title of *admiral:* and each has under him a vice-admiral and a rear-admiral, who are likewise flag-officers.

Navy Exercise. See Exercise.

Navy-Discipline, or *Regulations.* See *Maritime-State.*

NAWORTH Castle, in Cumberland, 10 miles from Carlisle, near the Gelt. This castle is still entire and inhabited. It is a large pile, square, and built round a court. On the north it stands over the river Ithing, at a great height, the banks shagged with wood. The whole house is a very irregular building, the rooms numerous, accessible by 16 staircases, with most frequent and sudden ascents and descents, &c.— The great hall has a gallery at one end, adorned with four vast crests carved in wood, viz. a griffin and dolphin, with the scollops; an unicorn, and an ox with a coronet round his neck. In front is a figure in wood of an armed man; two others, perhaps vassals, in short jackets and caps; a pouch pendant behind, and the mutilated remains of Priapus to each; one has wooden shoes. These seem the *ludibrium aulæ* in those gross days. The top and upper end of the room is painted in squares, to the number of 107, representing the Saxon kings and heroes. The chimney here is five yards and a half broad. Within this is another apartment, hung with old tapestry, a head of Ann of Cleeves; on one side of her a small picture of a lady in full length, &c. and many others. Many of these paintings were brought from Kirk-Oswald-castle when that was demolished. The chapel has a cieling, and part of its wainscot of the same kind, being paintings of Patriarchs, Jewish kings, &c. It has a floor of plaster of Paris, as have some other of the rooms. Some of the apartments are very large and spacious. The small Popish chapel is above stairs, and joining to this chapel is the library, which has a wooden roof; the books are old, there are not above one or two of the manuscripts here now. This castle was built by one of the Dacre's, about the reign of Henry III. In the garden walls were stones with Roman inscriptions, which the late earl of Carlisle gave to Sir Thomas Robinson, and were by him removed to his museum at Rooksby: On one of these stones is this inscription, *peditum centum quinquaginta Britannorum;* whence it appears that the Romans, when in possession of Britain, sometimes indulged the national troops with the favour of garrisoning their own territories.

NAXIA, or Naxos, a considerable island of the Archipelago, 25 miles in length, and 88 in circumference. The whole island is covered with orange, olive, lemon, cedar, citron, pomegranate, fig, and mulberry trees; and there are a great many springs and brooks. This island has no harbour; and yet they carry on a considerable trade in barley, wine, figs, cotton, silk, flax, cheese, salt, oxen, sheep, mules, and oil. They burn only oil of mastic, though olive-oil is exceeding cheap. It is inhabited both by Greeks and Latins, who live in great dread of the Turks: for when the meanest of their ships appear here, they always wear red caps like galley-slaves, and tremble before the lowest officer; but as soon as they are gone, they put on their caps of velvet. The ladies are so vain, that when they return out of the country,

they

they have 40 women in their train, half on foot and half on asses; one of whom carries a napkin or two, another a petticoat, another a pair of stockings, and so on; which is a very ridiculous sight to strangers There are four archbishops sees in this island, and a great many villages; but so thin of people, that the whole island does not contain above 8000 inhabitants. The highest mountain is *Zia*, which signifies "the mountain of Jupiter." There are but few antiquities, except some small remains of the temple of Bacchus. Some say they have mines of gold and silver; however, there is one of emery, which is so common here, and so cheap, that the English often ballast their ships therewith.

Naxos, or *Naxia*, a considerable town, and capital of the isle of Naxos, over-against the isle of Paros, with a castle and two archbishops sees, the one Greek and the other Latin. The greatest part of the inhabitants are Greeks. E. Long. 25. 51. N. Lat. 37. 8.

NAXUS, now Naxia, formerly *Strongyle*, *Dia*, *Dionysias*, *Callipolis*. and *Little Sicily*. It was called *Strongyle*, from a Greek word, signifying "round," though in reality it is rather square than round. The names of *Dia* or *Divine*, and *Dionysias*, were given it as being consecrated in a peculiar manner to the fabulous god Dionysus or Bacchus. The appellation of *Callipolis* Pliny and Solinus derive from the metropolis of the island, formerly a most beautiful city, which is the import of the word Callipolis. The great fertility of the country gave rise to the name of *Little Sicily*, Naxus being the most fruitful of all the Cyclades, as Agathemerus informs us, and no less fertile than Sicily itself. As for the name of *Naxus*, some assert that it was borrowed from one Naxus, under whose conduct the Carians possessed themselves of the island; others pretend it received its name from Naxus, the son of Endymion. Stephanus, Suidas, and Phavorinus, derive the name of *Naxos* from the Greek word *naxai*, signifying "to sacrifice," and will have it to have been so called from the many sacrifices offered here to Bacchus. With these Bocchart agrees, as to its being called *Naxos* from the sacrifices performed here in honour of Bacchus, but will have the word *naxos* to be a corruption of the Phœnician *nacsa*, or *nicsa*, signifying "a sacrifice, offering." Naxos is, according to Pliny, 75, but reckoned by the present inhabitants 100, miles in compass. It has Paros to the west, Myconos and Delos to the north, and Ios to the south. This island is the most fruitful of the Archipelago, and was formerly famed for the excellent wines it produced. Archilochus, as quoted by Athenæus, compares them to the nectar of the gods; and Asclepiades, cited by Stephanus, assures us, that Bacchus took more delight in Naxos than in any other place whatsoever, having himself taught the inhabitants to cultivate their vines. The wine of Naxos maintains to this day its ancient reputation, being by some deemed the best of the Levant. Besides wine, this island abounds with all sorts of delicious fruits, the plains being covered with orange, olive, lemon, cedar, citron, pomegranate, mulberry, and fig trees. It was formerly famous for quarries of that sort of marble which the Greeks called *ophites*, from its being green, and speckled with white spots like the skin of a serpent. The best emerald is found here on mountains near the western coast, whence the neighbouring cape is called by the Italians *capo smeriglio*, or the emerald cape. As to the inhabitants of Naxos, Diodorus relates that the island was first peopled by the Thracians. These were in a little time subdued by a body of Thessalians, who having possessed the island for the space of 200 years and upwards, were compelled to abandon it by a drought and famine.

After the Trojan war, the Carians settled here and called the island *Naxos*, from their king, who was the son of Polemon. He was succeeded by his son Leucippus, and Leucippus by his son Smardius, in whose reign Theseus, coming out of Crete, landed here with Ariadne, whom he was, in his sleep, commanded by Bacchus to leave in this island. In process of time a colony of Cnidians and Rhodians settled here under the conduct of Hippothous and Xuthus; the last of all the Ionians, who, in time, possessed the whole island; whence the Naxians are, by Herodotus, called *Ionians*, and ranked among the Athenian colonies. E. Long. 26. 5. N. Lat. 36. 30. It is about 105 miles in circumference and about 30 broad.

Naxus, (anc. geog.), a town of Crete, famous for its hones, called *lapis Naxius*. Another of Sicily, built by the Chalcidian; situated on the south side of Mount Taurus, destroyed by Dionysius the tyrant; from whose ruins Tauromenium, built by Timoleon, either arose or was increased, (Plutarch).

NAYLOR (James), a noted English enthusiast, was born, about 1616, in the parish of Ardesley, not far from Wakefield in Yorkshire. His father, though a farmer, and the proprietor of an estate, gave his son but a mean education; which is perhaps to be regretted, for his parts were very considerable. He married when very young and settled in Wakefield parish. In 1641 he was a private soldier under Lord Fairfax, being then a presbyterian: but he afterwards became an independent, and was made quarter-master under General Lambert. In 1651-2, he was converted by George Fox the apostle of the quakers, and soon commenced a preacher and prophet among that people. One of his prophecies was, that the last and general judgment should be on the 15th day of the ensuing November. The falsehood of this prediction was soon perceived, and of course his imposture ought to have been detected; but such is the power of enthusiasm over the human mind, that his fame rose daily; and upon his going to London in 1655, he excited to no common pitch the envy of his brethren. He had strange fancies of celestial illuminations, and considered himself as a great favourite of heaven. In 1656 he went into the west of England, but his extravagancies were so great and his opinions so blasphemous, that even in those days of fanatical delusion, they were heard with such horror, that the author of them was imprisoned in Exeter gaol; from which however he was relieved in the space of a month. Upon this he determined to return to London; but taking Bristol in his way, he made his entrance into that city in imitation of our Saviour's entrance into Jerusalem, the people strewing the way, &c. and calling out "Holy, holy, holy, lord god of Sabaoth; hosanna in the highest, &c." So impious a conduct could

could not escape animadversion: he was apprehended with six of his associates. On examination he defended all that had passed; and was soon after with his followers sent to London, imprisoned, and condemned to be whipt, and then put to hard labour. The sentence, though much petitioned against, was executed, and he recovered his senses, expressed his repentance, and was again received by the Quakers, who, during his impious frenzy, had disowned him. In 1659 he was freed from prison; and the following year set off to see his wife and children; but being robbed and left bound by the way, he was found in that state and carried to a friend's house at Rippon, where he died in November 1660. He was accounted the author of several works. His eccentricities, however, rather than his writings, have preserved his character; and he stands forward to the world, not so much as a man of genius or parts, though he was in some measure possessed of both, but rather as a striking example of the power of enthusiasm over the human mind, and of the danger of giving way to the religious reveries of an overheated imagination.

NAYRES, the nobility of the Malabar coast. We may with truth affirm that they are the oldest nobility in the world; for the most ancient writers mention them, and quote the law that permits the Nayre ladies to have many husbands; every one being allowed four. Their houses, which stand single, have as many doors as the lady has husbands. When one of them visits her, he walks round the house, striking with his sabre on his buckler: he then opens his door, and leaves a domestic with his arms in a kind of porch, who serves to inform others that the lady is engaged. It is said, that one day in the week the four doors are all opened, and all her husbands visit her, and dine together with her. Each husband gives a sum of money, or portion, at the time of marriage; and the wife only has the charge of the children. The Nayres, even the Samorin, and the other princes, have no other heirs than the children of their sisters. This law was established, that the Nayres, having no family, might be always ready to march against the enemy. When the nephews are of age to bear arms, they follow their uncles. The name of *father* is unknown to a Nayre child. He speaks of the husbands of his mother and of his uncles, but never of his father.

NAZARETH, a little city in the tribe of Zebulun, in Lower Galilee, to the west of Tabor, and to the east of Ptolemais. Eusebius says, it is fifteen miles from Legion towards the east. This city is much celebrated in the scriptures, for having been the usual place of the residence of Jesus Christ for the first 33 years of his life. Luke ii. 51. It was there our Saviour became incarnate, where he lived in obedience to Joseph and Mary, and from whence he took the name of a Nazarean. After he had begun to execute his mission, he preached there sometimes in the synagogue, *id.* iv. 16. But because his countrymen had no faith in him, and were offended at the meanness of his original, he did not many miracles there, Matth. xiii. 54. 58. nor would he dwell therein; so he fixed his habitation at Capernaum for the latter part of his life, *id.* iv. 13. The city of Nazareth was situated upon an eminence; and on one side there was a precipice, from whence the Nazareans one day had a design of throwing down our Saviour, because he upbraided them with their incredulity, Luke iv. 29.

St Epiphanius says, that in his time Nazareth was only a village, and that to the reign of Constantine it was inhabited by Jews alone, exclusive of all Christians. Adamnanus, a writer of the seventh age, says, that in his time there were two great churches to be seen at Nazareth, one in the midst of the city, built upon two arches, in the place where our Saviour's house had stood. Under the two arches now mentioned, was a very fine fountain, which furnished water to the whole city, and from whence water was drawn also by the help of a pulley for the use of the church above. The second church of Nazareth was built in a place where the house stood wherein the angel Gabriel revealed to the virgin Mary the mystery of our Lord's incarnation; and we are assured that the church of incarnation, which is supported by two arches, is still in being to this day. Mr Maundrell tells us, that there is a convent built over what is said to be the place of annunciation; for the chamber where she received the angel's salutation was about 500 years ago removed from Nazareth, and, according to the Roman legends, transported by angels to Loretto, then a small village in the pope's dominions, now become a bishop's see.—However, Calmet's opinion (which is certainly the true one) upon the different translations of this famous house of Loretto is, that they were no other than so many different buildings made upon the model of the church of Nazareth, just as in several places sepulchres have been built upon the model of that at Jerusalem. Mariti tells us, that in the eastern part of the city stands the church dedicated to the Blessed Virgin: the zeal of the Cœnobites raised it from the ruins of that which had been destroyed by the Saracens. It is a very handsome building, and consists of three naves; in the middle of which is the principal altar; to which there is an ascent by two magnificent stairs, much admired for their iron ballustrades, the work of an ingenious monk of the convent. The descent to the grotto or annunciation chapel below is by steps of beautiful marble, cut with great taste. Two beautiful columns of oriental granite strike the eye of the observer in the entrance. They appear to have been constructed both to support and ornament the grotto. The altar of this subterranean chapel is extremely elegant; and the different kinds of marble with which it is ornamented, receive an additional lustre from the combined light of several silver lamps presented by Christian princes. On solemn festivals, the walls and the pilasters are ornamented with various pieces of tapestry, representing the mysteries of the Virgin; a superb present from the House of Austria. In the western part of the city stands a Christian church, built, as is said, on the site of the ancient synagogue where Jesus showed the Jews the accomplishment of the prophecies in his person. This place served a long time as a shelter for flocks, but at present it is in good repair. In the neighbourhood may be seen a fountain of excellent water, which is, however, esteemed by the people on another account. They conjecture that it was contiguous to the habitation of the Virgin, and that it was used by her. At some distance is a large stone of a round form, called *Christ's Table*. It is

Nazarite.

pretended that he came hither more than once with his disciples to eat. The inhabitants of Nazareth pay it a kind of worship, by burning perfumes and incense around it. It is situated in 35° E. Long. and in 32° N. Lat.; and formerly held the third rank under the patriarch of Jerusalem. At present it is part of the domains of the chief of Acre. The ancient city, after the ravages of fanaticism, was reduced to a miserable hamlet, containing only a few Arab huts. Under the protection of Daher Omar, however, it recovered very considerably, and is now of far more importance.

NAZARITE, or NAZAREAN, or *Nazarines*, a term which may signify, 1. One that is of Nazareth, or any native of this city. 2. It was given to Jesus Christ and his disciples, and is commonly taken in a sense of derision and contempt, in such authors as have written against Christianity. 3. It has been taken for a sect of heretics called Nazareans. 4. For a Nazarite, a man that has laid himself under the obligation of a vow to observe the rules of Nazariteship, whether it be for his whole life, as Sampson and John the Baptist, or only for a time, as those mentioned in Numbers vi. 18, 19, 20. Amos ii. 11, 12. Lastly, the name Nazarite in some passages of scripture denotes a man of particular distinction and great dignity in the court of some prince. But we must speak of these several sorts of Nazarites something more distinctly.

The name of Nazarene belongs to Jesus Christ, not only because of his having lived the greatest part of his life at Nazareth, and because this city has always been considered as his country, but also because the prophets had foretold that he should be called a Nazarene, Matth. ii. 23. "And he came and dwelt in a "city called Nazareth, that it might be fulfilled which "was spoken by the prophets, He shall be called a "Nazarene." We find no particular place in the prophets in which it is said that the Messiah should be called a Nazarene; and St Matthew only quotes the prophets in general. Perhaps he would insinuate, that the consecration of the Nazarites, and the great purity of which they made profession, was a type and a sort of prophecy of those of our Saviour, or else that the name נזיר *Nazir* or *Nazarite* given to the patriarch Joseph, Gen. xlix. 26. Deut. xxxiii. 16. was a prophecy which was to be fulfilled in the person of Jesus Christ, of whom Joseph was a figure. Lastly, St Jerom was of opinion, that St Matthew here alludes to that passage of Isaiah xi. 1. and lx. 21. "And there shall come forth a rod out of the stem "of Jesse, and a branch (in Hebrew *Nezer*) shall grow "out of his roots." This branch or *Nezer*, and this rod, are certainly intended to denote Jesus Christ, by the general consent of all the fathers and interpreters.

When the word Nazarean is put for the heretics known by this name, it denotes Christians converted from Judaism, whose chief error consisted in defending the necessity or expediency of the works of the law, and who obstinately adhered to the practice of the Jewish ceremonies. The name of Nazarenes at first had nothing odious in it, and it was often given to the first Christians. The fathers frequently mention the gospel of the Nazarenes, which differs nothing from that of St Matthew, which was either in Hebrew or Syriac, for the use of the first converts, but was afterwards corrupted by the Ebionites. These Nazareans preserved this first gospel in its primitive purity. Some of them were still in being in the time of St Jerom, who does not reproach them with any error. They were very zealous observers of the law of Moses, but had the traditions of the Pharisees in very great contempt.

Nazarite, when put to signify those under the ancient law who made a vow of observing a more than ordinary degree of purity (Numb. *ubi cit.*), denotes a man or woman who engage themselves by a vow to abstain from wine and all intoxicating liquors, to let their hair grow without cutting or shaving, not to enter into any house that was polluted by having a dead corpse in it, nor to be present at any funeral. And if by chance any one should have died in their presence, they began again the whole ceremony of their consecration and Nazariteship. This ceremony generally lasted eight days, sometimes a month, and sometimes their whole lives. When the time of their Nazariteship was accomplished, the priest brought the person to the door of the temple, who there offered to the Lord a he-lamb for a burnt-offering, a she-lamb for an expiatory sacrifice, and a ram for a peace-offering. They offered likewise loaves and cakes, with wine necessary for the libations. After all this was sacrificed and offered to the Lord, the priest or some other shaved the head of the Nazarite at the door of the tabernacle, and burnt his hair, throwing it upon the fire of the altar. Then the priest put into the hand of the Nazarite the shoulder of the ram roasted, with a loaf and a cake, which the Nazarite returning into the hands of the priest, he offered them to the Lord, lifting them up in the presence of the Nazarite. And from this time he might again drink wine, his Nazariteship being now accomplished.

As to those that were perpetual Nazarites, as were Samson and John the Baptist, it appears that they were consecrated to their Nazariteship by their parents, and continued all their lives in this state, without drinking wine or cutting their hair.

Those that made a vow of Nazariteship out of Palestine, and could not come to the temple when their vow was expired, contented themselves with observing the abstinence required by the law, and after that cutting their hair in the place where they were: as to the offerings and sacrifices prescribed by Moses, which were to be offered at the temple by themselves, or by others for them, they deferred this till they could have a convenient opportunity. Hence it was, that St Paul being at Corinth, and having made the vow of a Nazarite, he had his hair cut off at Cenchrea, and put off fulfilling the rest of his vow till he should arrive at Jerusalem, Acts xviii. 18. When a person found that he was not in a condition to make a vow of Nazariteship, or had not leisure to perform the ceremonies belonging to it, he contented himself by contributing to the expence of the sacrifice and offerings of those that had made and fulfilled this vow; and by this means he became a partaker in the merit of such Nazariteship. When St Paul came to Jerusalem, in the year of Christ 58, the apostle St James the Less, with the other brethren, said to him, Acts xxi. 23, 24. that to quiet the minds of the converted Jews, who had been

been informed that he everywhere preached up the entire abolition of the law of Mofes, he ought to join himfelf to four of the faithful who had a vow of Nazariteſhip upon them, and contribute to the charge of the ceremony at the ſhaving of their heads; by which the new converts would perceive that he continued to keep the law, and that what they had heard of him was not true.

The Hebrew word *Nazir*, or Nazarite, which is made uſe of to expreſs a man exalted to great dignity, as it is ſaid of the patriarch Joſeph, Gen. xlix. 26. and Deut. xxxiii. 16. "that he was ſeparate from his brethren," as it is in our tranſlation; or as the Vulgate and others underſtand the Hebrew, "that he was "as a Nazarite among his brethren," is variouſly underſtood. Some think that the Hebrew word נזיר *Nazir*, in theſe places, ſignifies one who is crowned, choſen, ſeparated, or diſtinguiſhed: the word נזיר *Nazir* ſignifies a crown. The Septuagint tranſlate this word a chief, or him that is honoured. Calmet thinks that this was a term of dignity in the courts of eaſtern princes; and that at this day in the court of Perſia the word *Nazir* ſignifies the ſuperintendant general of the king's houſehold, the chief officer of the crown, the high ſteward of his family, treaſures, and revenues; and that in this ſenſe Joſeph was the Nazir of the court of Pharaoh. Le Clerc tranſlates the *Nazir*, a prince, and calls Joſeph "the prince of his brethren," in the two places already quoted. Mr Pool declares in favour of this laſt tranſlation. See *Joſeph. Chardin. Chryſoſt. St Jerom, &c.*

NAZIANZEN. See *Gregory Nazianzen.*

NAZIM, the lord lieutenant, viceroy, or governor of a province in Hindoſtan; the ſame as *Lubahdar*, or *Nabob.*

NEALED, among ſeamen, is uſed when the ſounding is deep water cloſe to the ſhore; as alſo when the ſhore is ſandy, clayey, oozy, or foul and rocky ground.

NEALING, or rather Annealing, a term uſed for the preparing of ſeveral matters, by heating or baking them in the oven, or the like.

Nealing of glaſs, is the baking of glaſs, to dry, harden, and give it the due conſiſtence, after it has been blown, and faſhioned into the proper works.—This is uſually performed in a kind of tower called the *leer*, built over the melting furnace. See Glass.

Nealing of glaſs is alſo uſed for the art of ſtaining glaſs with metalline colours. "One fine uſe of ſilver (ſays Mr Boyle) was only diſcovered ſince the art of annealing upon glaſs came to be practiſed. For prepared ſilver, or even the crude metal, being burnt on a glaſs plate, will tinge it of a fine yellow or golden colour. And there are ſeveral mineral earths, and other courſe matters of uſe in this art, which by means of fire impart tranſparent colours to glaſs, and ſometimes very different ones from thoſe of the bodies themſelves.

Nealing of ſteel, is the heating it in the fire to a blood-red heat, and then taking it out, and letting it cool gently of itſelf. This is done to make it ſofter, in order to engrave or punch upon it. See Tempering and Engraving.

Nealing is alſo uſed for the art or act of burning or baking earthen or other ware in an oven. The miners at Mendip, when they meet with a rock they cannot cut through, anneal it by laying on wood and coal, and contriving the fire ſo that they quit the mine before the operation begins, it being dangerous to enter it again before it be quite cleared of the ſmoke.

Nealing of tile is uſed in ancient ſtatutes for the burning of tile. The word is formed of the Saxon *onælan, accendere*, to light, burn

NEAP, or Neep-tides, are thoſe tides which happen when the moon is in the middle of the ſecond and fourth quarters. The neap-tides are low tides, in reſpect of their oppoſites the ſpring-tides. As the higheſt of the ſpring-tides is three days after the full or change, ſo the loweſt of the neap is four days before the full or change. On which occaſion the ſeamen ſay that it is deep neap.

NEAPED. When a ſhip wants water, ſo that ſhe cannot get out of the harbour, off the ground, or out of the dock, the ſeamen ſay ſhe is *neaped*, or *beneaped.*

NEAPOLIS (anc. geog.), a city of the Higher Egypt, in the Nomos Panopolitanus, between Thebæ to the ſouth, and Panopolis to the north, on the eaſt ſide of the Nile; otherwiſe called *Caene.*—A ſecond Neapolis of Babylonia, ſituated near the Euphrates on the ſouth ſide.—A third of Campania, an ancient town and a colony from Cumæ. (See Velleius, Pliny, Strabo); accounted a Greek city, and a great ſtickler for Greek uſages, (ſee Livy, Tacitus). Its hot baths were in nothing inferior to thoſe of Baiæ, according to Strabo: at two miles diſtance from it ſtands the monument of Virgil, held in religious veneration by learned poſterity. The Younger Pliny relates, that Virgil's birth-day was more religiouſly obſerved by Silius Italicus than his own, eſpecially at Naples, where he reſorted to his tomb as to a temple. The city is waſhed by the river Sebethus. Virgil feigns the nymph Sebethis to preſide over the ſtream. Now *Naples*, capital of the kingdom of that name. See Naples.—A fourth, Neapolis of Caria, near the Meander, (Ptolemy).—A fifth, an inland town of Cyrenaica, ſituated between Ptolemais and Arſinoe, (Ptolemy); and to be diſtinguiſhed from the Cænopolis, or Neapolis, on the eaſt border of the ſame province, (id). A ſixth of Ionia, (Strabo); which belonged firſt to the Epheſians, but afterwards to the Samians, who exchanged Marātheſium, a more diſtant city, for a nearer.—A ſeventh, Neapolis of Macedonia Adjecta, ſituated at the diſtance of 12 miles to the eaſt of Philippi, (Antonine).—An eighth, Neapolis of Piſidia, on the borders of Galatia, ſituated between Amblada and Pappa, (Ptolemy).—A ninth, of Samaria, the ancient *Sichem*, which ſee; ſo called upon its reſtoration by the Romans, (Coin, Pliny, Joſephus).—A tenth, of Sardinia, ſituated on the ſouth-weſt ſide of the iſland, 30 miles to the north of Metalla; now called *Neapoli.*—An eleventh, of the Regio Syrtica, called alſo *Leptis.*—A twelfth, of Zeugitana on the Mediterranean, to the eaſt of Clypea, and ſouth of the Promontorium Mercurii.

NEAT, or *Net Weight*, the weight of a commodity alone, clear of the caſk, bag, caſe, or even filth. See Net.

NEBIO, or Nebbio, a ruined city of Italy, on the north

north side of the island of Corsica, with a bishop's see, whose bishop resides at San Florenzo, from which it is a mile distant.

NEBO, (anc. geog.), a very high mountain, a part of the mountains Abarim, and their highest top, whither Moses was ordered to ascend to take a view of the land of Canaan, and there die. Situated in the land of Moab, over-against Jericho: with a cognominal town at its foot (Isaiah) belonging to the Reubenites, which afterwards returned to the Moabites; in Jerome's time desolate; eight miles to the south of Heshbon.

NEBO, or *Nabo*. See NABO.

NEBUCHADNEZZAR. See NABUCHADNEZZAR.

NEBULY, or NEBULEE, in heraldry, is when a coat is charged with several little figures, in form of words running within one another, or when the outline of a bordure, ordinary, &c. is indented or waved.

NECESSITY, whatever is done by a cause or power that is irresistible; in which sense it is opposed to freedom. Man is a necessary agent, if all his actions be so determined by the causes preceding each action, that not one past action could possibly not have come to pass, or have been otherwise than it hath been; nor one future action can possibly not come to pass, or be otherwise than it shall be. But he is a free agent, if he be able, at any time, under the circumstances and causes he then is, to do different things; or, in other words, if he be not unavoidably determined in every point of time, by the circumstances he is in, and the causes he is under, to do that one thing he does, and not possibly to do any other thing. Whether man is a necessary or a free agent, is a question which has been debated with much ingenuity by writers of the first eminence, from Hobbes and Clarke, to Priestley and Gregory. See METAPHYSICS, Part III. chap. 5. and PREDESTINATION.

NECESSITY, in mythology, a power superior to all other powers, and equally irresistible by gods and by men. Herodotus, as he is quoted by Cudworth, mentions an oracle which declared that "God himself could not shun his destined fate." And among the fragments of Philemon collected by Le Clerc, is the following sentence:

Δουλοι βασιλεων εσμεν, οἱ βασιλεις θεων, ὁ θεος αναγκης.

"We are subject to kings, kings to the gods, and God to necessity." Hence it is, that, in the Iliad, we find Jove himself, the sire of gods and men, regretting that he was restrained by *necessity* from rescuing his favourite son from the sword of Patroclus. Nay to such a height was this impiety carried in the earliest ages of Greece, that we find Hesiod and Homer teaching that the gods themselves were generated by *necessity*, of night and chaos.

This power, though always represented as blind and unintelligent, was however worshipped as a goddess, bearing in her hand large iron-nails, wedges, anchors, and melted lead *, as emblems of the inflexible severity of her nature. "In the city of Corinth she had a temple, in which the goddess *Violence* likewise resided, and into which no person was ever permitted to enter but the priest who officiated *in sacris* †."

* Horace, Lib. i. Ode 35.

† Pausanias in Corinth. Cap. 4.

Learned men have exercised their ingenuity in vain attempts to trace this portentous notion to its origin. Some, who wished to interpret it in a pious sense, have supposed that the gods who were subject to *necessity* were only those who were the ministers of the supreme *numen*; and that by *necessity* itself was meant nothing more than divine providence. But this is not consistent with Hesiod and Homer's generation of the gods, or with the epithets *sæva necessitas*, *dura necessitas*, by which this power was perpetually distinguished. Others, and among them Mosheim, have supposed that this monstrous fable was invented by the pagan priests, and diligently inculcated upon the minds of the people, in order to excuse the villanies of the objects of their worship. For, says he, who could be indignant at Jupiter's numberless adulteries, after it was known that in all his actions he was the servant of blind necessity? In the thefts of *Mercury*, the whoredoms of *Venus*, and the frequent squabbles of the other gods, there could be no moral turpitude, if they were under the influence of a superior power.

Numina cum videas duris obnoxia fatis,
Invidia possis exonerare deos ‡.

‡ Martial. Epigram. Lib. ix. N. 88. Ed. Amstel. 1701.

This account of the matter is at least as plausible as any other which is usually given; but the real case undoubtedly was, that when men "did not like to retain God in their knowledge, God gave them over to a reprobate mind to do those things which are not convenient; when their foolish heart was darkened, and professing themselves to be wise, they became fools." See PARCÆ.

NECESSITY, in law, as it implies a defect of will, excuses from the guilt of crimes. See CRIME.

Compulsion and inevitable *necessity* are a constraint upon the will, whereby a man is urged to do that which his judgment disapproves; and which, it is to be presumed, his will (if left to itself) would reject. As punishments are therefore only inflicted for the abuse of that free-will which God has given to man, it is highly just and equitable that a man should be excused for those acts which are done through unavoidable force and compulsion.

1. Of this nature, in the first place, is the obligation of *civil subjection*, whereby the inferior is constrained by the superior to act contrary to what his own reason and inclination would suggest: as when a legislator establishes iniquity by a law, and commands the subject to do an act contrary to religion or sound morality. How far this excuse will be admitted *in foro conscientiæ*, or whether the inferior in this case is not bound to obey the divine rather than the human law, it is not our business to decide; though, among the casuists, it is believed the question will hardly bear a doubt. But, however that may be, obedience to the laws in being is undoubtedly a sufficient extenuation of civil guilt before the municipal tribunal. The sheriff who burnt Latimer and Ridley, in the bigotted days of Queen Mary, was not liable to punishment from Elisabeth for executing so horrid an office; being justified by the commands of that magistracy which endeavoured to restore Superstition, under the holy auspices of its merciless sister, Persecution.

As to persons in private relations, the principal case where constraint of a superior is allowed as an excuse for criminal misconduct, is with regard to the matrimonial subjection of the wife to her husband:

Necessity. for neither a ſon nor a ſervant are excuſed for the commiſſion of any crime, whether capital or otherwiſe, by the command or coercion of the parent or maſter; though in ſome caſes the command or authority of the huſband, either expreſs or implied, will privilege the wife from puniſhment, even for capital offences. And therefore, if a woman commit theft, burglarly, or other civil offences againſt the laws of ſociety, by the coercion of her huſband, or even in his company, which the law conſtrues a coercion, ſhe is not guilty of any crime; being conſidered as acting by compulſion, and not of her own will. Which doctrine is at leaſt 1000 years old in this kingdom, being to be found among the laws of King Ina the Weſt-Saxon. And it appears, that, among the northern nations on the continent, this privilege extended to any woman tranſgreſſing in concert with a man, and to any ſervant that committed a joint offence with a freeman: the male or freeman only was puniſhed, the female or ſlave diſmiſſed; *procul dubio quod alterum libertas, alterum neceſſitas impelleret.* But (beſides that, in our law, which is a ſtranger to ſlavery, no impunity is given to ſervants, who are as much free agents as their maſters) even with regard to wives, this rule admits of an exception in crimes that are *mala in ſe*, and prohibited by the law of nature; as murder, and the like: not only becauſe theſe are of a deeper dye, but alſo, ſince in a ſtate of nature no one is in ſubjection to another, it would be unreaſonable to ſcreen an offender from the puniſhment due to natural crimes, by the refinements and ſubordinations of civil ſociety. In treaſon alſo (the higheſt crime which a member of ſociety can, as ſuch, be guilty of), no plea in coverture ſhall excuſe the wife; no preſumption of the huſband's coercion ſhall extenuate her guilt: as well becauſe of the odiouſneſs and dangerous conſequence of the crime itſelf, as becauſe the huſband, having broken through the moſt ſacred tie of ſocial community by rebellion againſt the ſtate, has no right to that obedience from a wife, which he himſelf as a ſubject has forgotten to pay. In inferior miſdemeanors alſo, we may remark another exception, that a wife may be indicted and ſet in the pillory with her huſband, for keeping a brothel: for this is an offence touching the domeſtic œconomy or government of the houſe, in which the wife has a principal ſhare; and is alſo ſuch an offence as the law preſumes to be generally conducted by the intrigues of the female ſex. And in all caſes where the wife offends alone, without the company or coercion of her huſband, ſhe is reſponſible for her offence as much as any feme-ſole.

2. Another ſpecies of compulſion or neceſſity is what our law calls *dureſs per minas*; or threats and menaces, which induce a fear of death or other bodily harm, and which take away for that reaſon the guilt of many crimes and miſdemeanors, at leaſt before the human tribunal. But then that fear which compels a man to do an unwarrantable action ought to be juſt and well-grounded; ſuch, "*qui cadere poſſit in virum conſtantem, non timidum et meticuloſum,*" as Bracton expreſſes it, in the words of the civil law. Therefore, in time of war or rebellion, a man may be juſtified in doing many treaſonable acts by compulſion of the enemy or rebels, which would admit of no excuſe in the time of peace. This, however, ſeems only, or at leaſt principally, to hold as to poſitive crimes, ſo created by the laws of ſociety, and which therefore ſociety may excuſe; but not as to natural offences, ſo declared by the law of God, wherein human magiſtrates are only the executioners of divine puniſhment. And therefore though a man be violently aſſaulted, and hath no other poſſible means of eſcaping death but by killing an innocent perſon, this fear and force ſhall not acquit him of murder; for he ought rather to die himſelf than eſcape by the murder of an innocent. But in ſuch a caſe he is permitted to kill the aſſailant; for there the law of nature, and ſelf-defence its primary canon, have made him his own protector.

3. There is a third ſpecies of neceſſity, which may be diſtinguiſhed from the actual compulſion of external force or fear; being the reſult of reaſon and reflection, which act upon and conſtrain a man's will, and oblige him to do an action which without ſuch obligation would be criminal. And that is, when a man has his choice of two evils ſet before him, and, being under a neceſſity of chooſing one, he chooſes the leaſt pernicious of the two. Here the will cannot be ſaid freely to exert itſelf, being rather paſſive than active; or, if active, it is rather in rejecting the greater evil than in chooſing the leſs. Of this ſort is that neceſſity, where a man by the commandment of the law is bound to arreſt another for any capital offence, or to diſperſe a riot, and reſiſtance is made to his authority: it is here juſtifiable, and even neceſſary, to beat, to wound, or perhaps to kill, the offenders, rather than permit the murderer to eſcape, or the riot to continue. For the preſervation of the peace of the kingdom, and the apprehending of notorious malefactors, are of the utmoſt conſequence to the public; and therefore excuſe the felony, which the killing would otherwiſe amount to.

4. There is yet another caſe of neceſſity, which has occaſioned great ſpeculation among the writers upon general law; viz. whether a man in extreme want of food or clothing may juſtify ſtealing either, to relieve his preſent neceſſities. And this both Grotius and Puffendorf, together with many other of the foreign juriſts, hold in the affirmative; maintaining by many ingenious, humane, and plauſible reaſons, that in ſuch caſes the community of goods, by a kind of tacit conceſſion of ſociety, is revived. And ſome even of our lawyers have held the ſame; though it ſeems to be an unwarranted doctrine, borrowed from the notions of ſome civilians; at leaſt it is now antiquated, the law of England admitting no ſuch excuſe at preſent. And this its doctrine is agreeable not only to the ſentiments of many of the wiſeſt ancients, particularly Cicero, who holds, That *ſuum cuique incommodum ferendum eſt, potius quam de alterius commodis detrahendum*; but alſo to the Jewiſh law, as certified by King Solomon himſelf: "If a thief ſteal to ſatisfy his ſoul when he is hungry, he ſhall reſtore ſevenfold, and ſhall give all the ſubſtance of his houſe:" which was the ordinary puniſhment for theft in that kingdom. And this is founded upon the higheſt reaſon: for mens properties would be under a ſtrange inſecurity, if liable to be invaded according to the wants of others; of which wants no man can poſſibly be an adequate judge, but the party himſelf who pleads them. In England eſpe-

eſpecially, there would be a peculiar impropriety in admitting ſo dubious an excuſe: for by the laws ſuch ſufficient proviſion is made for the poor by the power of the civil magiſtrate, that it is impoſſible that the moſt needy ſtranger ſhould ever be reduced to the neceſſity of thieving to ſupport nature. The caſe of a ſtranger is, by the way, the ſtrongeſt inſtance put to Baron Puffendorf, and whereon he builds his principal arguments: which, however they may hold upon the continent, where the parſimonious induſtry of the natives orders every one to work or ſtarve, yet muſt loſe all their weight and efficacy in England, where charity is reduced to a ſyſtem, and interwoven in our very conſtitution. Therefore our laws ought by no means to be taxed with being unmerciful, for denying this privilege to the neceſſitous; eſpecially when we conſider, that the king, on the repreſentation of his miniſters of juſtice, hath a power to ſoften the law, and to extend mercy in caſes of peculiar hardſhip. An advantage which is wanting in many ſtates, particularly thoſe which are democratical: and theſe have in its ſtead introduced and adopted, in the body of the law itſelf, a multitude of circumſtances tending to alleviate its rigour. But the founders of our conſtitution thought it better to veſt in the crown the power of pardoning particular objects of compaſſion, than to countenance and eſtabliſh theft by one general undiſtinguiſhing law.

NECHO, king of Egypt, began his reign 690 B. C. and was killed eight years after by Sabacon king of Ethiopia. Pſammiticus his ſon ſucceeded him, and was the father, as Herodotus informs us, of Necho II. who reigned in the 616 B. C. This Necho II. is celebrated in hiſtory for attempting, though in vain, to cut a canal from the Nile to the Arabian gulf. He carried his arms as far as the Euphrates, and conquered the city of Carchemiſh. This prince is not only known in ſcripture under the name of *Necho*, but alſo in profane hiſtory. He no ſooner ſucceeded to the crown than he raiſed great land armies, and fitted out vaſt fleets, as well upon the Mediterranean as upon the Red Sea: he gave battle to the Syrians near the city of Migdol; routed them, and made himſelf maſter of the city of Cadytis. The learned, however, are not agreed about this city Cadytis. Some will have it to be Cades in Arabia Petræa, others Jeruſalem; and others ſay it is the city of Cedes, or Kedeſh, in Galilee, in the tribe of Naphtali.

The ſcriptures acquaint us with the whole expedition of Necho in all its particulars. 2 Kings xxiii. 29. &c. and 2 Chr. xxxv. 20, 21, &c. In the year of the world 3394, this prince having drawn out his army into the field to make war with the Aſſyrians or Babylonians, and to take the city of Carchemiſh, otherwiſe called *Circuſium*, upon the Euphrates, Joſiah king of Judah, who was a tributary to the king of Babylon, marched to oppoſe his paſſage. Necho, who had no deſigns againſt him, ſent to tell him, What have I to do with you, king of Judah? It is not againſt you that I am come forth, but againſt another people, againſt whom the Lord has commanded me to make war. Leave off therefore to ſet yourſelf againſt me, for fear the Lord ſhould puniſh you for your reſiſtance. But Joſiah would not hearken to the remonſtrances of Necho, but gave him battle at Megiddo, where he received the wound of which he died. The people of Jeruſalem ſet up Jehoahaz for king of Judah, and Necho ſoon paſſed forwards, without making any longer ſtay in Judea.

But at his return from his expedition, which was very ſucceſsful, he halted at Riblah in Syria; and ſending for Jehoahaz king of the Jews, he depoſed him, loaded him with chains, and ſent him into Egypt. Then coming to Jeruſalem, he ſet up Eliakim, or Jehoiakim, in his place, and exacted the payment of 100 talents of ſilver and one talent of gold from the country. Jeremiah (xlvi. 2.) acquaints us, that the city of Carchemiſh was taken from Necho by Nebuchadnezzar king of Babylon, in the fourth year of Jehoiakim king of Judah; ſo that Necho did not enjoy his conqueſt above four years. Joſephus adds, that the king of Babylon purſuing his victory, brought under his dominion all the country which is between the Euphrates and Egypt, excepting Judea. Thus Necho was again reduced within the limits of his own country.

NECK, in anatomy, is the ſlender part ſituated between the head and trunk of the body. See ANATOMY, n° 31.

NECOPHORON, in botany, a name uſed by Pliny and other authors for the *ſmilax aſpera*, or *rough bindweed.*

NECROLIUM, a word uſed by ſome of the alchemical writers to expreſs a remedy almoſt always capable of averting death, and continuing life to its utmoſt period.

NECROLOGY, *necrologium*, formed of νεκρος, "dead," and λογος, "diſcourſe or enumeration," a book anciently kept in churches and monaſteries, wherein were regiſtered the benefactors of the ſame, the time of their deaths, and the days of their commemoration; as alſo the deaths of the priors, abbots, religious, canons, &c. This was otherwiſe called *calendar* and *obituary*.

NECROMANCY, the art of revealing future events by a pretended communication with the dead.

This ſuperſtitious and impious impoſture appears to have had its origin at a very early period in Egypt, and to have been thence propagated in every nation with the manners of which hiſtory has made us acquainted. The conqueſts of Seſoſtris might introduce it into India; the Iſraelites would naturally borrow it from the people among whom they ſojourned 400 years; and it would eaſily find its way into Phœnicia, from the vicinity of that country to the land of its nativity. From the Egyptians and Phœnicians it was adopted, with the other rites of paganiſm, by the Greeks; and it was imported into Rome with Grecian literature and Grecian manners. It was not however confined to the pagan nations of antiquity; it ſpread itſelf through all the modern nations of Europe, and took ſuch deep root as to be long retained even after thoſe nations were converted to the Chriſtian faith.

Of its early antiquity we have complete evidence in the writings of Moſes, where it is ſeverely condemned as an abomination to the Lord *; and though it appears to have been even then ſpread into Phenicia, we might yet conclude its birth-place to have been Egypt, becauſe, at their *exody*, the Iſraelites were

* Deut. xviii. 10, 11, 12.

Necromancy. corrupted only by Egyptian superstitions, and because necromancy seems to be one of those whoredoms which the prophet Ezekiel represents his countrymen as having brought with them from Egypt, and continued to practise till they were carried captives into Babylon.

If from sacred we proceed to consult profane authors, we shall find them not only affirming Egypt to have been the birth-place of necromancy, but in some degree accounting for the origin of so impious a delusion. From Diodorus the Sicilian † we learn, that the Grecian fable of *Charon* the ferry-man of hell, of *Styx*, *Coccytus*, the *Elysian Fields*, *Tartarus*, the judgement of *Minos*, and *Radamanthus*, &c. with the whole scenery of the infernal regions, were imported from Egypt into Greece. The ancient Egyptians, and indeed all the people of the east, made use of caves for burying places, which were well suited to the solemn sadness of the surviving friends, and proper receptacles for those who were never more to behold the light. In Egypt, many of those subterraneous cavities being dug out of the natural rock, still remain and command the admiration of travellers; and near to the pyramids in particular there are some apartments of a wonderful fabric, which though they extend in length 4400 feet, and are about 30 feet in depth, appear to have been, if not entirely dug, at least reduced to form by the chizzel or pick-axe of the artist.

† Lib. i. § 2.

From the practice of burying in such caverns sprung the opinion that the infernal mansions were situated somewhere near the centre of the earth, which by the Egyptians was believed to be not very distant from its surface ‡. In these dreary mansions, it was very easy for such adepts as the priests of Egypt to fabricate Erebus, Tartarus, the Elysian Fields, and all those scenes which were displayed before the initiated (see Mysteries), and by them described to the million of the people. As it was in those dark abodes that necromancy was practised, it would be no difficult matter for such magicians as withstood Moses to impose so far upon the credulous vulgar, as to make them believe, that in consequence of their avocations they actually saw the ghosts of their friends ascend out of the earth. It appears from the book of Exodus, that the Israelitish women were, even in the wilderness, well acquainted with the use of the mirror, which was therefore undoubtedly known to the Egyptians. But a mirror of a particular form and properly illuminated at the instant required, might easily be made to reflect, in a cavern from which all other light was carefully excluded, the image of the deceased, who was called upon by the necromancer; and we can readily conceive, that with respect to the question to be proposed, a person might be concealed, prepared to give such ambiguous answers as would satisfy the inquirer, and at the same time save the credit of the oracle. The terrified imaginations of the spectators would aid the delusion, and make a very slight resemblance pass for the ghost or ειδωλον of their departed friend; or the necromancer might assign plausible reasons why a spectre, after having dwelt for some time in the infernal regions, should lose something of its resemblance to the body which it animated. Such juggling tricks, though performed by artists less accomplished than Jannes and Jambres, have gained credit among people much more enlightened than the Egyptians can possibly have been when the science of necromancy was invented by their priests.

‡ *Bryant's Analysis of Mythology.*

That the Israelites, notwithstanding the prohibition of their legislator, continued to practise the rites of necromancy, is apparent from Saul's transaction with the witch of Endor (see Magic). From the same transaction, it is likewise apparent that the witches of Israel, and therefore in all probability the necromancers of Egypt, pretended to evocate the ghosts of the dead by a *dæmon* or *familiar spirit*, which they had at their command to employ upon every emergency. This dæmon was called ob; and therefore Saul desires his servants to find him a woman who was mistress of an ob (a). It is probable that those wretched impostors had in their pay some persons who occasionally acted the part of the dæmon, and when the execution of the plot required their agency, emitted, by means of a cavity dug for that purpose, a low hollow voice from below the ground. Hence we find Isaiah, in his denunciations against Ariel*, saying, "Thou shalt be brought down, and shalt speak out of the ground; and thy speech shall be low out of the dust, and thy voice shall be as one that hath a familiar spirit (an ob) out of the ground, and thy speech shall whisper out of the dust."

* Chap. xxix. 4.

But though the Egyptian priests were undoubtedly the inventors of the whole mystery of necromancy, and though it was from them imported into Greece by the Selli or priests of Dodona, it does not appear that the Grecian necromancers pretended to be masters of obs or familiar spirits. Mopsus, Orpheus, Linus, Eumolpus, &c. who either travelled into Egypt in quest of knowledge, or were actually natives of that country, instructed the early Greeks in this occult science: but whatever might be the practice of these apostles themselves, their disciples professed to do all

(a) The orginal, or radical, signification of this word occurs in Job xxxii. ver. 19; where Elihu compares his belly to new bottles, which he calls *oboth*, the plural of *ob*. But as bottles were then made of leather, new bottles filled with wine and ready to burst, as Elihu describes them, would of course be of a form nearly globular. Hence it may be inferred that the original import of *ob* was *round* or *globular*: but *b* and *p* being labials, are often changed into each other; and therefore from the Hebrew *ob* is derived the Greek οψ *oculus*, οπτομαι *video*, and the Latin *ops*, a name under which the earth was worshipped. *Upis* was a name of Diana or the moon: the father of one of the Dianas was likewise *upis*; but this *upis* was undoubtedly the sun. Now the difference between *upis* and *opis* is nothing; hence we are led to believe that as they are all derived from *ob*, this word was employed by the early idolaters of Egypt to denote the first and greatest of Pagan gods, the sun. If so, those wretches who pretended to be mistresses of *obs*, were exactly the same kind of impostors with the Pythonesses of the Greeks.

Necromancy.

all the feats of magic by performing certain rites, by offering certain facrifices, by muttering a certain form of words, by charms, fpells, and exorcifms. By thefe they pretended to evocate the dead as certainly as the Egyptians and Jews did by their *familiar fpirits*. By a fmall difplay of critical learning this might be eafily proved from the popular ftory of Orpheus and Euridice, which certainly was founded on one of thefe necromantic deceptions exhibited in a cave near Dodona, where the priefts had a *hades* or infernal manfion, in humble imitation of thofe with which the firft of them were well acquainted in Egypt. It is indeed evident, without the aid of criticifm: no man of any letters is ignorant, that whatever fuperftitions of this kind prevailed among the Romans were borrowed from the Greeks. But we all know that Virgil makes one of his fhepherds, by means of certain herbs, poifons, and fenfelefs charms, raife up ghofts from the bottoms of their graves; and Lucan has fabricated a ftory of this kind, which may be confidered as an exact parallel to the witch of Endor. Juft before the battle of Pharfalia he makes † young Pompey travel by night to a Theffalian forcerefs, and anxioufly inquire of her the iffue of the war. This female necromancer, by a tedious procefs of charms and incantations, conjures up the ghoft of a foldier who had been lately flain. The phantom, after a long preamble, denounces a prediction much of the fame kind with that which the king of Ifrael received from Samuel at Endor; and though we have elfewhere fhown, that nothing but the fpirit of God could have forefeen the inevitable deftruction of Saul, his fons, and his army (fee MAGIC), it was very eafy for any man of tolerable fagacity to forefee the defeat of Pompey's raw and undifciplined troops by the hardy veterans of the victorious Cæfar.

† Lib. vi. ver. 570. et feq.

It would be endlefs to enumerate all the fallacious evocations of ghofts, and the ambiguous refponfes returned by thofe pretended fpirits, of which we have accounts from the poets and hiftorians of the celebrated nations of antiquity. We fhall therefore proceed to mention a few which occur in the fabulous hiftory of more modern nations, and then leave the fubject to the meditation of our readers. In Mallet's northern antiquities, we have the following account of a necromantic exploit, between which, and the defcent of the ancient heroes into hell, it is impoffible not to remark a ftriking fimilitude.

"Odin the fovereign of man arifes. He faddles his horfe Sleipner; he mounts, and is conveyed to the fubterraneous abode of *Hela*. The dog which guards the gates of death meets him. His breaft and his jaws are ftained with blood. He opens his voracious mouth to bite, and barks a long time at the father of magic. Odin purfues his way; and the infernal cavern refounds and trembles under his horfe's hoofs. At length he reaches the deep abode of death, and ftops near the eaftern gate, where ftands the tomb of the prophetefs. He fings with a voice adapted to call up the dead; he looks towards the world; he engraves Runic characters on her tomb; he utters myfterious words; and he demands an anfwer, until the prophetefs is conftrained to arife and thus utter the words of the dead.—"Who is this unknown that dares to difturb my repofe, and drag me from the grave, in which I have been dead fo long, all covered with fnow, and moiftened with the rains?" &c.

The Gallic druids pretended to be mafters of the fame fecret. This is evident from the name of a fpecies of divination, not uncommon among the Scotch Highlanders fo lately as in the beginning of the prefent century. By a gentleman excellently verfed in the antiquities of that people, and a fteady friend to the writer of this article, we have been informed, that not many years ago fome of the Highlanders relied implicitly upon certain oracular refponfes, called in their language *taghairm*. This word feems to be compounded of *ta*, which in fome parts of the Highlands is ftill ufed to denote a fpirit or ghoft, and *ghairm*, which fignifies *calling upon* or invoking. *Taghairm*, therefore, in its original import, is *necromancy* in the moft proper fenfe of that word.

There were different kinds of *taghairm*, of which one was very lately practifed in *Sky*. The diviner covered himfelf with a cow's hide, and repaired at night to fome deep-founding cave, whither the perfon who confulted him followed foon after without any attendants. At the mouth of the cave he propofed aloud the queftions of which he wanted folutions; and the man within pronounced the refponfes in a tone of voice fimilar to that with which the OBS, or pretended dæmons of antiquity, gave from beneath the ground their oracular anfwers. That in the latter days of *taghairm*, the Gallic diviners pretended to evocate ghofts, and from them to extort folutions of difficulties propofed, we have no pofitive evidence; but that fuch was the original pretence, there can be little doubt, when we reflect either upon the place where this fpecies of divination was practifed, or upon the import of the word by which it was denominated.

As we have been led to mention *taghairm*, we fhall beg leave to make a few obfervations on another fpecies of it, called *taghairm an uifge*, or "*taghairm* by water." This too was laft practifed in the Ifle of Sky, by a man of the name of *M'Cuidhean*, whofe anceftors had long been famous for the art. He lived near a beautiful cafcade on a fmall river; and when confulted on any matter of confequence, he covered his whole body with a cow's hide, that neceffary implement of Highland divination, and placed himfelf between the water of the cafcade and the rock over which it flowed. Then another man with a heavy pole gave repeated ftrokes to the water, and the diviner behind it crying out now and then in Gaelic, "Is this a ftock of arn?" This operation was continued till M'Cuidhean was perceived to be frantic or furious, when he was confidered as in a condition to anfwer the moft important queftions. He was frequently confulted about futurity; and though he could not, in the proper fenfe of the word, be called a *necromancer*, his refponfes were liftened to as proceeding from fomething more than human. A degree of frenzy, either real or affected, feems to have accompanied the predictions of certain kinds of diviners in all ages; and we cannot help remarking the fimilarity between the madnefs of M'Cuidhean and that of the Sybil in the fixth book of the Æneid; though we

Necropolis Nectarium.

cannot suppose the one to have been borrowed from the other.

> *At, Phœbi nondum patiens, immanis in antro*
> *Bacchatur vates, magnum si pectore possit*
> *Excussisse Deum: tanto magis ille fatigat*
> *Os rabidum, fera corda domans, fingitque premendo.*

> Struggling in vain, impatient of her load,
> And lab'ring underneath the pond'rous god;
> The more she strove to shake him from her breast,
> With more and far superior force he press'd.
>
> *Dryden.*

That all these pretences, whether ancient or modern, to the power of divination by means of familiar spirits, or by the art of necromancy, were groundless as well as impious, it would be affronting the understandings of our readers to offer any proof. Under the article MAGIC we have said enough on the subject, and perhaps more than enough, to those who know that dæmons, if they have any existence, and the departed spirits of good and bad men, are all under the controul of Him who governs the intellectual as well as material world by fixed and equal laws.—These details of superstition, however, will not be useless, if, by showing how poor and wretched a creature man becomes when left to his own inventions, they shall make any one grateful for the benefits of good government, and the blessings of revealed religion.

NECROPOLIS, a suburb of Alexandria in Egypt. It signifies "the City of the Dead;" wherein there were temples, gardens, and superb mausoleums. Here Cleopatra is said to have applied the aspic to her breast, to prevent being led in triumph by Augustus, who endeavoured to save her.

NECROSIS, νεκρωσις, in medicine, a complete mortification of any part; called also *sideratio* and *sphacelus*.

NECTANEBUS, or NECTANABIS, a king of Egypt, who defended his country against the Persians. His grandson of the same name made an alliance with Agesilaus king of Sparta, and with his assistance he quelled a rebellion of his subjects. Sometime after he was joined by the Sidonians, Phœnicians, and inhabitants of Cyprus, who had revolted from the king of Persia. This powerful confederacy was soon attacked by Darius the king of Persia, who marched at the head of his troops. Nectanebus, to defend his frontiers against so dangerous an enemy, levied 20,000 mercenary soldiers in Greece, the same number in Libya, and 60,000 were furnished in Egypt. This numerous body was not equal to the Persian forces, and Nectanebus, defeated in a battle, gave up all hopes of resistance, and fled into Ethiopia, where he found a safe asylum. His kingdom of Egypt became from that time tributary to the king of Persia.

NECTAR, among ancient poets, the drink of the fabulous deities of the heathens; in contradistinction from their solid food, which was called *ambrosia*.

NECTARINE, a fruit differing in nothing from the common peach, of which it is a species, than in having a smoother rind and a firmer pulp. See PERSICA.

NECTARIUM, from *nectar*, the fabled "drink of the gods;" defined by Linnæus to be a part of the corolla, or appendage to the petals, appropriated for containing the honey, a species of vegetable salt under a fluid form, that oozes from the plant, and is the principal food of bees and other insects.

Notwithstanding this definition, which seems to consider the nectarium as necessary a part of the corolla as the petals; it is certain that all flowers are not provided with this appendage, neither indeed is it essential to fructification.

There is, besides, a manifest impropriety in terming the nectarium a part of the corolla. Linnæus might, with equal propriety, have termed it a part or appendage of the stamina, calyx, or pointal, as the appearance in question is confined to no particular part of the flower, but is as various in point of situation as of form. The truth is, the term *nectarium* is exceedingly vague; and, if any determinate meaning can be affixed to it, is expressive of all the singularities which are observed in the different parts of flowers. *Milne's Bot. Dict.*

The tube, or lower part of flowers with one petal, Linnæus considers as a true nectarium, because it is generally found to contain the sweet liquor formerly mentioned. This liquor Pontedera compares to that called *amnios* in pregnant animals, which enters the fertile or impregnated seeds: but that this is not at least its sole use, is evident from this circumstance, that the honey or liquor in question is to be found in flowers where there are either no seeds, or those which, from the want of male organs, cannot be impregnated. Thus the male flowers of nettle and willow, the female flowers of sea-side laurel and black bryony, the male and female flowers of clutia, higgelaria, and butcher's broom, all abound with the honey or nectar alluded to.

Dr Vaillant was of opinion, that the nectarium was an essential part of the corolla; for which reason he distinguished the singular appearances in fennel-flower and columbine by the name of *petals*: the coloured leaves which are now termed the *petals* he denominates the *flower cup*.

That the nectarium, however, is frequently distinct from the petals, is evident both from the well-known examples just mentioned, as likewise from the flowers of monkshood, hellebore, isopyrum, fennel-flower of Crete, barrenwort, grass of Parnassus, chocolate-nut, cherleria, and sauvagesia.

These general observations being premised, we proceed to take a nearer and more particular view of the principal diversities, both in form and situation, of this striking appendage to the flower. 1. In many flowers the nectarium is shaped like a spur or horn; and that either in flowers of one petal, as valerian, water-milfoil (*urticularia*), butter-wort, and calves-snout; or in such as have more than one, as lark-spur, violet, fumatory, balsam, and orchis. 2. In the following plants, the nectarium is properly a part of the corolla, as lying within the substance of the petals: ranunculus, lily, iris, crown-imperial, water-leaf, mouse-tail, ananas or pine-apple, dog's-tooth violet, piperidge bush, vallisneria, hermannia, uvularia, and swertia. 3. The nectarium is frequently placed in a series or row within the petals, though entirely unconnected with their substance. In this situation it often resembles a cup, as in narcissus. A nectarium of this kind is said by Linnæus to crown the corolla. The following are examples: daffodil, sea-daffodil, campion, viscous campion,

pion, fwallow-wort, ftapelia, cynanchum, nepenthes, cherleria, balfam-tree, African fpiræa, witch-hazel-olax, and paffion-flower. 4. In Indian crefs, buckler, muftard, Barbadoes cherry, and monotropa, the nectarium is fituated upon or makes part of the calyx. 5. The nectarium in baftard flower-fence is feated upon the antheræ or tops of the ftamina; whence the name *adenanthera*, or *glandular anthera*, which has been given to this genus of plants. In the following lift it is placed upon the filaments; bean-caper, bay, fraxinella, marvel of Peru, bell-flower, lead-wort, roella, and commelina. 6. In hyacinth, flowering-rufh, ftock July-flower, and rocket, the nectarium is placed upon the feed-bud. 7. In honey-flower, orpine, buck-wheat, collinfonia, lathræa, navel-wort, mercury, clutia, kiggelaria, fea-fide laurel, and African fpiræa, it is attached to the common receptacle. Laftly, in ginger, nettle, dyer's weed, heart-feed, coftus, turmeric, grewia, baftard-orpine, vanelloe, fkrew-tree, and willow, the nectarium is of a very fingular conftruction, and cannot properly fall under any of the foregoing heads.

In difcriminating the genera, the nectarium often furnifhes an effential character.

Plants which have the nectarium diftinct from the petals, that is, not lodged within their fubftance, are affirmed by Linnæus to be generally poifonous. The following are adduced as examples: monk's hood, hellebore, columbine, fennel-flower, grafs of Parnaffus, barren-wort, oleander, marvel of Peru, bean-caper, fucculent fwallow-wort, fraxinella, and honey flower.

NECUIA, in botany, a name given by the ancient Greeks to a fpecies of mullein.

The Greeks and Romans both ufed the ftalks of a peculiar kind of mullein, called *thryallis* by Nicander. For the making of wicks of lamps we have a kind of mullein called *lychnites*, and candle-wick mullein, from the λυχνιτις of Diofcorides; but it is not certain that ours is the fame plant.

The ancients ufed the ftalks of many different plants for the wicks of their candles and lamps. The rufh, ftripped of its bark, was as commonly in ufe with them as with us for this purpofe; and they alfo ufed the nettle, this mullein, and many other plants, whofe ftalks were compofed of tough filaments, for the fame purpofe; beating them out like hemp, and when dry dipping them in melted refin, and other fuch inflammable fubftances. When thus prepared, they are readily inflammable, like our flambeau; and this mullein, having ftalks more long and large, and more firm than all the others, was ufed to make thofe lights with which they fet fire to the funeral pile, for confuming the afhes of their dead friends.

NECYDALIS, in zoology, a genus of infects belonging to the order of coleoptera. The feelers are fetaceous; the elytra are fhorter and narrower than the wings; the tail is fimple. There are 11 fpecies, chiefly diftinguifhed by the fize and figure of their elytra. Barbut fays, "Its head is black, eyes are large and prominent, jaws are of a dark brown. The antennæ placed on the top of the head between the eyes have their firft articulation long and raifed upright, the reft bent and turned afide. The antennæ vary as to length and colour. In individuals whofe thorax is yellow, they are brown, and equal only to two-thirds of the body in length. On the contrary, in thofe whofe thorax is black, they are likewife black, and fomewhat longer than the body. The thorax is margined; in fome it is yellow and longer; in others it is black, fhorter, and edged only with a little yellow. The elytra are blackifh, fomewhat clearer in the middle, and terminating in a lemon coloured fpot. The wings are rather black, fomething longer than the body, exceed the elytra by one-third, and are croffed one over the other. In thofe that have their thorax yellow, the legs and under part of the belly are fo likewife. In individuals with a black thorax, the legs are black as well as the belly, which has only a little yellow on the fides. I fufpect the latter to be the males. The larva is as yet unknown."

NEDHAM (Marchmont), an Englifh fatyrical writer, was born at Burford Oxon. about the month of Auguft 1620. His father died in 1621; but the following year his mother was again married to one Chriftopher Glynn, vicar and fchoolmafter of Burford; who perceiving his fon-in-law's pregnancy of parts and genius, took him under his own tuition, and at the age of 14 fent him to All Souls College, Oxon. Here he was made one of the chorifters, and continued till 1637, when, having taken the degree of A. B. which made it inconfiftent to continue in that office, he went to St Mary's Hall till he became an ufher in Merchant-Taylor's fchool, London. About the beginning of the civil wars, he became clerk to an attorney at Gray's Inn, where, writing a good court hand, he obtained a decent fubfiftence. Not long after this, he began a weekly paper, under the title of *Mercurius Britannicus*, on the fide of the parliament: it commenced about the middle of Auguft 1643, coming out on Mondays, in one fheet, and continued till the end of 1646. It procured him popularity, and being an active man he was diftinguifhed by the title of Capt. Nedham of Gray's Inn. Of thefe mercuries (for there were a number of them publifhed on both fides of the great queftion which then divided the nation), it is well obferved by Johnfon, that they taught many to talk whom they could not teach to judge. Nedham's was, indeed, addreffed as much to the paffions as the reafon; and, by telling every man that he was equal to his king, he fo flattered vulgar pride, that his licentious opinions were received as the dictates of an oracle. About this time he ftudied phyfic, and in 1645 began to practife; by which, and his political writings, he fupported a genteel figure. But, for fome fcorn and affront put upon him, he fuddenly left his party, and, obtaining the favour of a royalift, was introduced into the king's prefence at Hampton-court in 1647, and afking pardon upon his knees readily obtained it; fo that being admitted to the king's favour, he wrote foon after another paper, entitled *Mercurius Pragmaticus*; which being equally witty with the former, as fatirical againft the Prefbyterians, and full of loyalty, made him known and admired by the wits of that fide. However, being narrowly fought after, he left London, and for a time lay concealed at the houfe of Dr Peter Heylin, at Minfter-Lovel, near Burford, till at length being difcovered, he was imprifoned in Newgate, and in danger of his life. Lenthal, the fpeaker of the Houfe of Commons, who knew him and his relations

Nedham, Needham.

relations well, and Bradfhaw, prefident of the high-court of juftice, treated him favourably, and not only got his pardon, but with promife of rewards and places perfuaded him to change his fide once more for the independents, who then were the uppermoft party.—In this temper he publifhed a third weekly paper, called *Mercurius Politicus*, which came out every Wednefday, in two fheets 4to, commencing with the 9th of June 1649, and ending with the 6th of June 1650, which being Thurfday, he began again with number 1. from Thurfday June 6, to Thurfday June 13, 1650, beginning, "Why fhould not the commonwealth have "a fool, as well as the king had, &c." This paper, which contained many difcourfes againft monarchy, and in behalf of a free ftate, efpecially thofe that were publifhed before Cromwell was made protector, was carried on without any interruption till about the middle of April 1660, when, as feveral times before, it was prohibited by an order of the council of ftate.—Upon the return of Charles II. our author lay hid, till, by virtue of fome money well placed, he obtained his pardon under the great feal; after which he exercifed the faculty of phyfic among the Diffenters, which brought him in a confiderable benefit till his death, which happened fuddenly in 1678. Wood, who knew him, tells us that he was a perfon endowed with quick natural parts, was a good humanift, poet, and boon droll; and, had he been conftant to his cavaliering principles, would have been beloved and admired by all; but being mercenary, and preferring his intereft to his confcience, friendfhip, and love to his prince, was much hated by the royal party to the laft. In fhort, there was no depending on this fcurrilous ill-natured author. He followed whenever intereft or paffion led, and remains a notorious inftance of the danger of brilliant parts, of which he certainly was poffeffed, without judgment or integrity to controul them. Wood, who in his Athen. Oxon. quoted above, gives a very copious account of him, fays: "At length this moft feditious, mutable, and railing "author, M. Nedham, died fuddenly, in the houfe "of one Kidder, in D'Eureux-court near Temple-"bar, London, in 1678, and was buried near the "entrance of the chancel of the church of St Clements Danes."

Athen. Oxon. vol. ii.

NEEDHAM (John Tuberville), was born at London the 10th of September in the year 1713. His parents were defcended from ancient and noble families. His father, who had once poffeffed a confiderable patrimony at Hilfton, in the county of Monmouth, was of the younger and Catholic branch of the Needham family: the head of the elder and Proteftant branch was lord Kilmory, created vifcount in the year 1625. The father of Mr Needham died young, and left but a fmall fortune to his four children. His eldeft fon, who is the fubject of this article, profecuted his ftudies under the fecular clergy of the Englifh college of Douai, where he took orders, taught rhetoric for feveral years, gave eminent proofs of fagacity and genius, and furpaffed all the other profeffors of that feminary in the knowlegde of experimental philofophy. In 1740, he was engaged by his fuperiors in the fervice of the Englifh miffion, and was entrufted with the direction of the fchool erected at Twyford, near Winchefter, for the education of the Roman Catholic youth. In 1744, he was appointed profeffor of philofophy in the Englifh college at Lifbon, where, on account of his bad health, he remained only 15 months. After his return, he paffed feveral years at London and Paris, which were principally employed in microfcopical obfervations, and in other branches of experimental philofophy. The refults of thefe obfervations and experiments were publifhed in the Philofophical Tranfactions of the Royal Society of London in 1749, and in a volume in 12mo at Paris in 1750; and an account of them was alfo given by M. de Buffon, in the firft volumes of his Natural Hiftory. There was an intimate connection between this illuftrious French naturalift and Mr Needham: they made their experiments and obfervations together; though the refults and fyftems which they deduced from the fame objects and operations were totally different. Mr Needham was admitted to a place in the Royal Society of London in the year 1747, and in the Antiquarian Society fome time after. From the year 1751 to 1767 he was chiefly employed in finifhing the education of feveral Englifh and Irifh noblemen, by attending them as tutor in their travels through France, Italy, and other countries. He then retired from this wandering life to the Englifh feminary at Paris, and in 1768 was chofen by the Royal Academy of Sciences in that city a correfponding member.

Needham.

When the regency of the Auftrian Netherlands, in order to the revival of philofophy and literature in that country, formed the project of an Imperial academy, which was preceded by the erection of a fmall literary fociety to prepare the way for its execution, Mr Needham was invited to Bruffels by Count Cobentzel and the prefident Neny, and was appointed fucceffively chief director of both thefe foundations. He held this place, together with fome ecclefiaftical preferments in the Low Countries, until his death, which happened the 30th of December 1781. "His piety, temperance, and purity of manners (we follow the expreffions of the Abbé Mann) were eminent: his attachment to the doctrines and duties of Chriftianity was inviolable. His zealous oppofition to modern infidels was indefatigable and even paffionate. His probity was untainted. He was incapable of every fpecies of duplicity; his beneficence was univerfal, and his unfufpicious candour rendered him often a dupe to perfidy." Thefe and other good qualities the panegyrift attributes to his deceafed friend; and the learned authors of the Monthly Review, to whom Mr Needham was known, admit the juftnefs of the panegyric. He was undoubtedly (fay they) both an honeft man and a worthy citizen; but though his death be a real lofs to the literary world, yet he died feafonably for himfelf; for had he lived to fee Jofeph the IId. and the Great making fo free with the paint, patches, and trinkets of the mother church, confifcating her lands, abolifhing her convents, fuppreffing her holidays, introducing common fenfe into her worfhip, erecting political conductors to difperfe the thunder of the Vatican, and atchieving many other things in this ftyle of improvement, it would have vexed full fore his feeling heart. For this honeft man was narrow even to fuperftition and bigotry in his religious fyftem; and we never knew a man in whom there was fuch an

unaccountable mixture of implicit faith and philosophical curiosity as in Mr Needham. He was a keen and judicious observer of nature, had a peculiar dexterity in confirming his observations by experiments, and he was always occupied (sometimes indeed with too much fancy and precipitation) in generalizing facts, and reducing them to his system. "His pen (says Abbé Mann) was neither remarkable for fecundity nor method: his writings are rather the great lines of a subject expressed with energy, and thrown upon paper in a hurry, than finished treatises." His works are well known both in Britain and in France.

NEEDHAM, in Suffolk, 73 miles from London, stands on the Orwell, 9 miles from Ipswich, in the road to Huntingdonshire. Its market is on Wednesday, and fair in October 28.

NEEDLE, a very common little instrument or utensil made of steel, pointed at one end, and pierced at the other, used in sewing, embroidery, tapestry, &c.

Needles make a very considerable article in commerce, though there is scarce any commodity cheaper, the consumption of them being almost incredible.— The sizes are from n° 1. the largest, to n° 25. the smallest. In the manufacture of needles, German and Hungarian steel are of most repute.

In the making of them, the first thing is to pass the steel through a coal fire, and under a hammer, to bring it out of its square figure into a cylindrical one. This done, it is drawn through a large hole of a wire-drawing iron, and returned into the fire, and drawn through a second hole of the iron smaller than the first; and thus successively from hole to hole, till it has acquired the degree of fineness required for that species of needles; observing every time it is to be drawn, that it be greased over with lard, to render it more manageable. The steel thus reduced to a fine wire, is cut in pieces of the length of the needles intended. These pieces are flatted at one end on the anvil, in order to form the head and eye: they are then put into the fire, to soften them farther; and thence taken out and pierced at each extreme of the flat part on the anvil, by force of a puncheon of well-tempered steel, and laid on a leaden block to bring out, with another puncheon, the little piece of steel remaining in the eye. The corners are then filed off the square of the heads, and a little cavity filed on each side of the flat of the head; this done, the point is formed with a file, and the whole filed over: they are then laid to heat red-hot on a long narrow iron, crooked at one end, in a charcoal fire; and when taken out thence, are thrown into a bason of cold water to harden. On this operation a good deal depends; too much heat burns them, and too little leaves them soft; the medium is learned by experience. When they are thus hardened, they are laid in an iron shovel on a fire more or less brisk in proportion to the thickness of the needles; taking care to move them from time to time. This serves to temper them, and take off their brittleness; great care here too must be taken of the degree of heat. They are then straightened one after another with the hammer, the coldness of the water used in hardening them having twisted the greatest part of them.

The next process is the polishing them. To do this, they take 12,000 or 15,000 needles, and range them in little heaps against each other on a piece of new buckram sprinkled with emery-dust. The needles thus disposed, emery-dust is thrown over them, which is again sprinkled with oil of olives; at last the whole is made up into a roll, well bound at both ends. This roll is then laid on a polishing table, and over it a thick plank loaded with stones, which two men work backwards and forwards a day and a half, or two days, successively; by which means the roll thus continually agitated by the weight and motion of the plank over it, the needles withinside being rubbed against each other with oil and emery, are insensibly polished. After polishing, they are taken out, and the filth washed off them with hot water and soap: they are then wiped in hot bran, a little moistened, placed with the needles in a round box, suspended in the air by a cord, which is kept stirring till the bran and needles be dry. The needles thus wiped in two or three different brans, are taken out and put in wooden vessels, to have the good separated from those whose points or eyes have been broken either in polishing or wiping; the points are then all turned the same way, and smoothed with an emery-stone turned with a wheel. This operation finishes them, and there remains nothing but to make them into packets of 250 each. Needles were first made in England by a native of India in 1545, but the art was lost at his death: it was, however, recovered by Christopher Greening in 1560, who was settled with his three children, Elizabeth, John, and Thomas, by Mr Damar, ancestor of the present lord Milton, at Long Crendon in Bucks, where the manufactory has been carried on from that time to this present day.

*Dipping-*NEEDLE, or *Inclinatory Needle*, a magnetical needle, so hung, as that, instead of playing horizontally, and pointing out north and south, one end dips, or inclines to the horizon, and the other points to a certain degree of elevation above it. Plate CCCXLV. fig. 1.

The dipping-needle was invented in the year 1576 by one Robert Norman a compass-maker at Wapping. The occasion of the discovery, according to his own account, was, that it being his custom to finish and hang the needles of his compasses before he touched them, he always found, that immediately after the touch, the north-point would bend or incline downward, under the horizon; insomuch that, to balance the needle again, he was always forced to put a piece of wax on the south end as a counterpoise. The constancy of this effect led him at length to observe the precise quantity of the dip, or to measure the greatest angle which the needle would make with the horizon; and this at London he found to be 71° 50′. In 1723 Mr Graham made a great many observations on the dipping-needle, and found the angle to be between 74 and 75 degrees. Mr Nairne, in 1772, found it to be somewhat above 72°. It is not certain whether the dip varies, as well as the horizontal direction, in the same place. The trifling difference between Mr Forman and Mr Nairne would lead us to imagine that the dip was unalterable; but Mr Graham, who was a very accurate observer, makes the difference more considerable. It is certain, however, from a great number of experiments and observations, that the dip is variable in different latitudes, and that it increases in going northwards. It appears from a table of observations made with the marine dipping-needle in a voyage

voyage towards the north pole in 1733, that in lat. 60. 18. the dip was 75°; and in lat. 70. 45. it was 77° 52′; in lat. 80. 12. it was 81° 52′; and in lat. 80. 27. it was 82° $2\frac{1}{2}$′.

Several authors have endeavoured to apply this discovery of the dip to the finding of the latitude; and Mr Bond attempted to apply it to the finding of the longitude alſo; but for want of obſervations and experiments he could not make any progreſs. The affair was farther proſecuted by Mr Whiſton, who publiſhed a treatiſe on the longitude, and for ſome time imagined it was poſſible to find it exactly by means of the dip of the needle; yet he at laſt deſpaired of it, for the following reaſons. 1. The weakneſs of the magnetic power. 2. The concuſſion of the ſhip, which he found it exceeding difficult to avoid ſo much as was neceſſary for the accuracy of the experiments. 3. The principal objection was an irregularity in the motions of all magnetic needles, both horizontal and dipping, by which they, within the compaſs of about a degree, vary uncertainly backward and forward; even ſometimes, in a few hours time, without any evident cauſe. For a particular account of theſe variations both of the horizontal and dipping needle, ſee the article VARIATION.

Mr Nairne made a dipping-needle in 1772 for the board of longitude, which was uſed in the voyage towards the north-pole. This is repreſented Plate CCCXLV. fig. 2. The needle AA is 12 inches long, and its axis, the ends BB of which are made of gold alloyed with copper, reſts on friction-wheels CCCC, of four inches diameter, each end on two friction-wheels; which wheels are balanced with great care. The ends of the axes of the friction-wheels are likewſe of gold alloyed with copper, and moved in ſmall holes made in bell-metal; and oppoſite to the ends of the axes of the needle and the friction-wheels, are flat agates, ſet in at DDD, finely poliſhed. The magnetic needle vibrates within a circle of bell-metal, EEE, divided into degrees and half degrees; and a line, paſſing through the middle of the needle to the ends, points to the diviſions. The needle of this inſtrument was balanced before it was made magnetical; but by means of a croſs, the ends of which are FFFF, (contrived by the reverend Mr Mitchell) fixed on the axis of the needle, on the arms of which are cut very fine ſcrews to receive ſmall buttons, that may be ſcrewed nearer or farther from the axis, the needle may be adjuſted both ways to a great nicety, after being made magnetical, by reverſing the poles, and changing the ſides of the needle. GG are two levels, by which the line of 0 degrees of the inſtrument is ſet horizontal, by means of the four adjuſting ſcrews LLLL; H is the perpendicular axis, by which the inſtrument may be turned, that the divided face of the circle may front the eaſt or weſt; to this axis is fixed an index I, which points to an oppoſite line on the horizontal plate K when the inſtrument is turned half round; MMMM are ſcrews which hold the glaſs-cover to keep the needle from being diſturbed by the wind. When this needle is conſtructed for ſea, it is ſuſpended by an univerſal joint on a triangular ſtand, and adjuſted vertically by a plumb-line and button above the divided circle and the dovetail work at the upper 90; and the diviſions on the circle are adjuſted ſo as to be perpendicular to the horizon by the ſame plumb-line, and an adjoining ſcrew; and when it is adjuſted, a pointer annexed to a ſcrew, which ſerves to move the divided circle, is fixed at the loweſt 90. Whenever the inſtrument is uſed to find the dip, it muſt be ſo placed that the needle may vibrate exactly in the magnetic meridian.

Magnetical NEEDLE, in navigation, a needle touched with a loadſtone, and ſuſtained on a pivot or centre; on which playing at liberty, it directs itſelf to certain points in or under the horizon; whence the magnetical needle is of two kinds, viz. horizontal or inclinatory. See the article MAGNET.

Horizontal needles are thoſe equally balanced on each ſide of the pivot that ſuſtains them; and which, playing horizontally with their two extremes, point out the north and ſouth points of the horizon. For their application and uſe, ſee the article COMPASS.

In the conſtruction of the horizontal needle, a piece of pure ſteel is provided; of a length not exceeding ſix inches, leſt its weight ſhould impede its volubility; very thin, to take its verticity the better; and not pierced with any holes, or the like, for ornament ſake, which prevent the equable diffuſion of the magnetic virtue. A perforation is then made in the middle of its length, and a braſs cap or head ſoldered on, whoſe inner cavity is conical, ſo as to play freely on a ſtyle or pivot headed with a fine ſteel point. The north point of the needle in our hemiſphere is made a little lighter than the ſouthern; the touch always deſtroying the balance, if well adjuſted before, and rendering the north end heavier than the ſouth, and thus occaſioning the needle to dip.

The method of giving the needle its verticity or directive faculty has been ſhown already under the article MAGNET; but if, after touching, the needle be out of its equilibrium, ſomething muſt be filed off from the heavier ſide, till it balance evenly.

Needles in ſea-compaſſes are uſually made of a rhomboidal or oblong form: we have given their ſtructure already under the article COMPASS.

The needle is not found to point preciſely to the north, except in very few places; but deviates from it more or leſs in different places, and that too at different times; which deviation is called its *declination* or *variation from the meridian*. See the article VARIATION.

Surgeons NEEDLES are generally made crooked, and their points triangular: however they are of different forms and ſizes, and bear different names, according to the purpoſes they are uſed for.

The largeſt are needles for amputation; the next, needles for wounds; the fineſt needles for futures. They have others, very ſhort and flat, for tendons; others, ſtill ſhorter, and the eye placed in the middle, for tying together of veſſels, &c. Needles for couching cataracts are of various kinds; all of which have a ſmall, broad, and ſharp point or tongue; and ſome with a fulcus at the point. Surgeons have ſometimes uſed two needles in this operation; one with a ſharp point for perforating the coats of the eye, and another with a more obtuſe point for depreſſing or couching the opaque cryſtalline lens: but care ſhould be taken in the uſe of any of theſe, that they be firſt well poliſhed with cloth or leather, before they are applied to the eye.

Mr Warner obſerves, that the blade of the couching needle

needle ſhould be at leaſt a third part larger than thoſe generally uſed upon this occaſion, as great advantages will be found in the depreſſing of the cataract, by the increaſed breadth of the blade of that inſtrument. The handle, alſo, if made ſomewhat ſhorter than uſual, will enable the operator to perform with greater ſteadineſs, than he can do with a larger handled inſtrument.

It is to be obſerved, that needles of ſilver pierce more eaſily in ſtitching arteries after an amputation, than thoſe made of ſteel.

Needle-Fiſh. See Sygnathus.

Needles, ſharp-pointed rocks north of the Iſle of Wight. They are ſituated at the weſtern extremity of the iſland, which is an acute point of high land, from which they have been disjoined by the waſhing of the ſea. There were of theſe lofty white rocks formerly three, but about 14 years ago the talleſt of them, called *Lot's Wiſe*, which aroſe 120 feet above low-water mark, and in its ſhape reſembling a needle, being undermined by the conſtant efforts of the waves, overſet, and totally diſappeared.

NEEDS, or St Neots, ſix miles from Huntingdon, 58 miles from London, ſo called from the monument of a ſaint of that name in it, who was burnt by the Danes, is a large well-built town, having a handſome ſtrong church, with a prodigious fine ſteeple, and a good ſtone-bridge over the Ouſe, by which coals are brought to it, and ſold through the country. It has a charity-ſchool for 25 poor children. Its market is on Thurſday; fairs on Holy Thurſday, Aug. 1. Corpus-Chriſti Thurſday, June 13. and December 17.; and it is famous for a medicinal ſpring.

NEEDWOOD-forest, in Staffordſhire, between the Trent, Dove, and Blythe, and near Uttoxeter, is ſaid to exceed all the foreſts in England in the excellency of its ſoil, and the fineneſs of its turf.

NE EXEAT REGNO, in law, is a writ to reſtrain a perſon from going out of the kingdom without the king's licence. F. N. B. 85. It may be directed to the ſheriff, to make the party find ſurety that he will not depart the realm, and on refuſal to commit him to priſon: or it may be directed to the party himſelf; and if he then goes, he may be fined. And this writ is granted on a ſuit being commenced againſt a man in the chancery, when the plaintiff fears the defendant will fly to ſome other country; and thereby avoid the juſtice and equity of the court; which hath been ſometimes practiſed: and when thus granted, the party muſt give bonds to the maſter of the rolls, in the penalty of 1000 l. or ſome other large ſum, for yielding obedience to it; or ſatisfy the court, by anſwer, affidavit, or otherwiſe, that he hath no deſign of leaving the kingdom, and give ſecurity.

NEFERN, in Pembrokeſhire, a village in whoſe church-yard is a remarkable old croſs. The church has no pavement in it, and the frequent burials have raiſed the ground within it to ſeven or eight feet higher than without. In proceſs of time, inſtead of a church, it will be only a ſepulchre. It is pleaſantly ſituated on the banks of a river of the ſame name near Newport.

NEFASTI dies, in Roman antiquity, an appellation given to thoſe days wherein it was not allowed to adminiſter juſtice, or hold courts. They were ſo called becauſe, *non fari licebat*, the prætor was not allowed to pronounce the three ſolemn words or formulas of the law, *do*, *dico*, *addico*, I give, I appoint, I adjudge. Theſe days were diſtinguiſhed in the calendar by the letter N. for *nefaſtus*; or N. P. *Nefaſtus Primo*, when the day was only *nefaſtus* in the forenoon, or firſt part. The days of a mixed kind were called *intercifi*.

NEGAPATAN, a town of Aſia in the peninſula on this ſide the Ganges, and on the coaſt of Coromandel. It was firſt a colony of the Portugueſe, but was taken from them by the Dutch. The factory purchaſe very little beſides tobacco and long linen cloths; however, the Dutch have thought proper to erect a fort here. It is ſituated in E. Long. 79. 10. N. Lat. 11. 15.

NEGATION, in logic, an act of the mind affirming one thing to be different from another; as that the ſoul is not matter. See Logic.

NEGATIVE, in general, ſomething that implies a negation: thus we ſay, negative quantities, negative powers, negative ſigns, &c.

Negative-Sign. The uſe of the negative ſign, in algebra, is attended with ſeveral conſequences that at firſt ſight are admitted with difficulty, and has ſometimes given occaſion to notions that ſeem to have no real foundation. This ſign implies, that the real value of the quantity repreſented by the letter to which it is prefixed is to be ſubtracted; and it ſerves, with the poſitive ſign, to keep in view what elements or parts enter into the compoſition of quantities, and in what manner, whether as increments or decrements, (that is, whether by addition or ſubtraction), which is of the greateſt uſe in this art.

In conſequence of this, it ſerves to expreſs a quantity of an oppoſite quality to the poſitive, as a line in a contrary poſition; a motion with an oppoſite direction; or a centrifugal force in oppoſition to gravity; and thus often ſaves the trouble of diſtinguiſhing, and demonſtrating ſeparately, the various caſes of proportions, and preſerves their analogy in view. But as the proportions of lines depend on their magnitude only, without regard to their poſition, and motions and forces are ſaid to be equal, or unequal, in any given ratio, without regard to their directions; and, in general, the proportion of quantity relates to their magnitude only, without determining whether they are to be conſidered as increments or decrements; ſo there is no ground to imagine any other proportion of $-b$ and $+a$ (or of -1 and 1) than that of the real magnitudes of the quantities repreſented by b and a, whether theſe quantities are, in any particular caſe, to be added or ſubtracted. It is the ſame thing to ſubtract a decrement, as to add an equal increment, or to ſubtract $-b$ from $a-b$, as to add $+b$ to it: and becauſe multiplying a quantity by a negative number implies only a repeated ſubtraction of it, the multiplying $-b$ by $-n$, is ſubtracting $-b$ as often as there are units in n; and is therefore equivalent to adding $+b$ ſo many times, or the ſame as adding $+nb$. But if we infer from this, that 1 is to $-n$ as $-b$ to nb, according to the rule, that unit is to one of the factors as the other factor is to the product, there is no ground to imagine that there is any myſtery in this, or any other meaning than that the real magnitudes repreſented by 1, n, b, and nb are proportional. For that rule relates only to the magnitude

nitude of the factors and product, without determining whether any factor, or the product, is to be added or ſubtracted. But this likewiſe muſt be determined in algebraic computations; and this is the proper uſe of the rules concerning the ſigns, without which the operation could not proceed. Becauſe a quantity to be ſubtracted is never produced in compoſition by any repeated addition of a poſitive, or repeated ſubtraction of a negative, a negative ſquare number is never produced by compoſition from the root. Hence $\sqrt{-1}$, or the ſquare root of a negative, implies an imaginery quantity; and, in reſolution, is a mark or character of the impoſſible caſes of a problem, unleſs it is compenſated by another imaginary ſymbol or ſuppoſition, when the whole expreſſion may have a real ſignification. Thus $1+\sqrt{-1}$, and $1-\sqrt{-1}$ taken ſeparately, are imaginary, but their ſum is 2; as the conditions that ſeparately would render the ſolution of a problem impoſſible, in ſome caſes deſtroy each others effect when conjoined. In the purſuit of general concluſions, and of ſimple forms repreſenting them, expreſſions of this kind muſt ſometimes ariſe where the imaginary ſymbol is compenſated in a manner that is not always ſo obvious.

By proper ſubſtitutions, however, the expreſſion may be transformed into another, wherein each particular term may have a real ſignification as well as the whole expreſſion. The theorems that are ſometimes briefly diſcovered by the uſe of this ſymbol, may be demonſtrated without it by the inverſe operation, or ſome other way; and though ſuch ſymbols are of ſome uſe in the computations by the method of fluxions, its evidence cannot be ſaid to depend upon arts of this kind. See Maclaurin's Fluxions, book ii. chap. 1. and Ludlam's Algebra, *paſſim*.

Negative Electricity. See the article *Electricity*, *paſſim*. See alſo *Positive Electricity*.

NEGINOTH. This term is read before ſome of the Pſalms, as Pſalm lxvii. It ſignifies *ſtring inſtruments of muſic*, to be played on by the fingers, or women-muſicians; and the titles of thoſe pſalms where this word is found, may be thus tranſlated, *A pſalm of David to the maſter of muſic, who preſides over the ſtring inſtruments*.

NEGOMBO, a ſea-port town of Aſia, on the weſt coaſt of Ceylon. It has a fort built by the Portugueſe, which was taken from them by the Dutch in 1640. E. Long. 80. 25. N. Lat. 17. 0.

NEGRIL point, the moſt weſterly promontory of the iſland of Jamaica.

NEGRO, *Homo pelli nigra*, a name given to a variety of the human ſpecies, who are entirely black, and are found in the Torrid zone, eſpecially in that part of Africa which lies within the tropics. In the complexion of negroes we meet with many various ſhades; but they likewiſe differ far from other men in all the features of their face. Round cheeks, high cheek-bones, a forehead ſomewhat elevated, a ſhort, broad, flat noſe, thick lips, ſmall ears, uglineſs, and irregularity of ſhape, characterize their external appearance. The negro women have the loins greatly depreſſed, and very large buttocks, which gives the back the ſhape of a ſaddle. Vices the moſt notorious ſeem to be the portion of this unhappy race: idleneſs, treachery, revenge, cruelty, impudence, ſtealing, lying, profanity, debauchery, naſtineſs, and intemperance, are ſaid to have extinguiſhed the principles of natural law, and to have ſilenced the reproofs of conſcience. They are ſtrangers to every ſentiment of compaſſion, and are an awful example of the corruption of man when left to himſelf.

The origin of the negroes, and the cauſe of thier remarkable difference from the reſt of the human ſpecies, has much perplexed the naturaliſts. Mr Boyle has obſerved, that it cannot be produced by the heat of the climate: for though the heat of the ſun may darken the colour of the ſkin, yet experience does not ſhow that it is ſufficient to produce a new blackneſs like that of the negroes.

In Africa itſelf, many nations of Ethiopia are not black; nor were there any blacks originally in the Weſt Indies. In many parts of Aſia, under the ſame parallel with the African region inhabited by the blacks, the people are but tawny. He adds, that there are negroes in Africa beyond the ſouthern tropic; and that a river ſometimes parts nations, one of which is black, and the other only tawny. Dr Barriere alleges, that the gall of Negroes is black, and being mixed with their blood is depoſited between the ſkin and ſcarf-ſkin. However, Dr Mitchel of Virginia, in the Philoſophical Tranſactions n° 476. has endeavoured by many learned arguments to prove, that the influence of the ſun in hot countries, and the manner of life of their inhabitants, are the remote cauſes of the colour of the Negroes, Indians, &c. Lord Kaimes, on the other hand, and ſuch philoſophers as he, whoſe genius and imagination are too lively to ſubmit to a dry and painful inveſtigation of facts, have contended, that no phyſical cauſe is ſufficient to change the colour, and what we call the regular features of white men, to the dark hue and deformity of the woolly-headed negro. Their arguments have been examined with much acuteneſs and ingenuity by Dr Stanhope Smith of New Jerſey, Dr Hunter, and profeſſor Zimmerman, who have made it in a high degree probable, that the action of the ſun is the original and chief cauſe of the black colour, as well as diſtorted features, of the negro. See America, n° 48—51. and Complexion.

True negroes are found in no quarter of the globe where the heat of the climate is not very great. They exiſt no where but in the Torrid zone, and only in three regions ſituated in that zone, to wit, in Senegal, in Guinea, and on the weſtern ſhores of Africa, in Nubia, and the Papous' land, or what is called *New Guinea*. In all theſe regions the atmoſphere is ſcorching, and the heat exceſſive. The inhabitants of the north are whiteſt; and as we advance ſouthwards towards the line, and thoſe countries on which the ſun's rays fall more perpendicularly, the complexion gradually aſſumes a darker ſhade. And the ſame men, whoſe colour has been rendered black by the powerful action of the ſun, if they remove to the north, gradually become whiter (at leaſt their poſterity), and loſe their burnt colour. Whites, when tranſported into the burning regions of the Torrid zone, are at firſt ſubject to fever; the ſkin of the face, hands, and feet, becomes burnt, hardens, and falls off in ſcales. Hitherto the colour of negroes appears to be only local, extrinſic, and accidental, and their ſhort frizzled

frizzled and ſparſe hair is to be accounted for in the very ſame manner.

Climate poſſeſſes great and evident influence on the hair, not only of men, but of all other animals. If in one caſe theſe tranſmutations are acknowledged to be conſiſtent with identity of kind, they ought not in the other to be eſteemed criterions of different ſpecies. Nature has adapted the pliancy of her work to the ſituations in which ſhe may require it to be placed. The beaver and ſheep removed to the warm latitudes exchange, the one its fur, and the other its wool, for a coarſe hair that preſerves the animal in a more moderate temperature. The coarſe and black ſhag of the bear is converted, in the arctic regions, into the fineſt and whiteſt fur. The colour of the hair is likewiſe changed by climate. The bear is white under the arctic circle; and, in high northern latitudes, foxes, hares, and rabbits, are found white. Similar effects of climate are diſcernible on mankind. The hair of the Danes is generally red; of the Engliſh, fair or brown; and of the French, commonly black. The hair of all people of colour is black, and that of the African negroes is likewiſe ſparſe and curled in a manner peculiar to themſelves; but this peculiarity is analogous to the effect which a warm climate has on almoſt every other animal. Cold, by obſtructing the perſpiration, tends to throw out the perſpirable matter accumulated at the ſkin in an additional coat of hair. A warm climate, by opening the pores, evaporates this matter before it can be concreted into the ſubſtance of hair; and the laxneſs and aperture of the pores render the hair liable to be eaſily eradicated by innumerable incidents. Its curl may reſult in part from the nature of the ſecretion by which it is nouriſhed, and in part from external heat. That it depends in ſome degree on the quality of the ſecretion is rendered highly probable from its appearance on the chin and other parts of the human body. Climate is as much diſtinguiſhed by the nature and proportion of the ſecretions as by the degree of heat: (See Physiology, ſect. 6.) Whatever be the nutriment of the hair, it is evidently combined in the torrid zone of Africa with ſome fluid of a highly volatile or ardent quality, which produces the rank ſmell of many African nations. Saline ſecretions tend to curl and to burn the hair. The evaporation of any volatile ſpirit would render its ſurface dry and diſpoſed to contract; whilſt the centre continuing diſtended by the vital motion, theſe oppoſite dilatations and contractions would neceſſarily produce a curve, and make the hair grow involved. External and violent heat parching the extremities of the hair, tends likewiſe to involve it. A hair held near the fire inſtantly coils itſelf up. Africa is the hotteſt country on the globe; and the influence of its heat, either external or internal, or both, in giving the peculiar form to the hair of the natives, appears, not only from its ſparſeneſs and its curl, but from its colour. It is not of a ſhining, but of an aduſt black; and its extremities tend to brown, as if it had been ſcorched by the fire.

The peculiarities of the negro-features and form may likewiſe be accounted for from the exceſſive heat of the climate and the ſtate of African ſociety. Being ſavages, they have no arts to protect them from the rays of a burning ſun. The heat and ſerenity of the ſky preſerving the lives of the children without much care of the parents, they ſeem of courſe to be, in the interior parts of the country, negligent of their offspring. Able themſelves to endure the extremes of that ardent climate, they inure their children to it from their moſt tender age. They ſuffer them to roll in the duſt and ſand beneath the direct rays of a vertical ſun. The mother, if ſhe be engaged, lays down the infant on the firſt ſpot ſhe finds, and is ſeldom at the pains to ſeek the miſerable ſhelter of a barren ſhrub, which is all that the interior country affords. When we reflect on the influence of a glare of light upon the eye, and on the contortions of countenance produced by our efforts to repel or prevent it, we need not wonder that the pliant features of a negro-infant ſhould, by conſtant expoſure, acquire that permanent irregularity which we term their characteriſtic uglineſs. But beſides the climate, food and clothing and modes of life have prodigious effects on the human form and features. This is apparent even in poliſhed ſocieties, where the poor and labouring part of the community are much more coarſe in their features, and ill-formed in their limbs, than perſons of better fortune and more liberal means of ſubſiſtence. What an immenſe difference exiſts in Scotland, for inſtance, between the chiefs and the commonalty of the Highland clans? If they had been ſeparately found in different countries, they would have been ranged by ſome philoſophers under different ſpecies. A ſimilar diſtinction takes place between the nobility and peaſantry of France, of Spain, of Italy, and of Germany.

That food and clothing, and the different modes of life, have as great an influence upon the ſhapes and features of the Africans as upon the natives of Europe, is evident from the different appearances of the negroes in the ſouthern republics of America according to the ſtations in which they are employed. "The field ſlaves (ſays Dr Smith) are badly fed, clothed, and lodged. They live in ſmall huts on the plantations, where they labour, remote from the ſociety and example of their ſuperiors. Living by themſelves, they retain many of the cuſtoms and manners of their African anceſtors. The domeſtic ſervants, on the other hand, who are kept near the perſons, or employed in the families of their maſters, are treated with great lenity; their ſervice is light; they are fed and clothed like their ſuperiors; they ſee their manners, adopt their habits, and inſenſibly receive the ſame ideas of elegance and beauty. The field ſlaves are, in conſequence, ſlow in changing the aſpect and figure of Africa. The domeſtic ſervants have advanced far before them in acquiring the agreeable and regular features, and the expreſſive countenance of civil ſociety. The former are frequently ill-ſhaped. They preſerve, in a great degree, the African lips, noſe, and hair. Their genius is dull, and their countenance ſleepy and ſtupid. The latter are ſtraight and well proportioned; their hair extended to three, four, and ſometimes even to ſix or eight inches; the ſize and ſhape of the mouth handſome, their features regular, their capacity good, and their look animated."

Upon the whole, we hope that the reader, who ſhall candidly weigh in his own mind what we have ſaid at preſent and under the article Complexion, will agree with us, that the black colour in the torrid zone, the ſparſe criſp hair of the negroes, and the peculiarities of their features and form, proceed from cauſes altogether extrinſic; that they depend on local temperature and the ſtate of ſociety; and that they are as accidental as the various

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various shades of colour which characterize the different nations of Europe. If the whites be considered as the stock whence all others have sprung, it is easy to conceive how they have degenerated into negroes. Some have conjectured that the complete change may have taken place at the end of three centuries, whilst others have thought that it could not be effected in less than double that period. Such conjectures can be formed from no certain data; and a much greater length of time is undoubtedly necessary before negroes, when transplanted into our temperate countries, can entirely lose their black colour. By crossing the breed with whites, every taint of the negro-colour may be expelled, we believe, from the fifth generation (A).

But the most serious charge brought against the poor negroes is, that of the *vices* said to be natural to them. If they be indeed such as their enemies represent them, treacherous, cruel, revengeful, and intemperate, by a necessity of *nature*, they must be a different race from the whites; for though all these vices abound in Europe, it is evident that they proceed not from nature, but from wrong education, which gives to the youthful mind such deep impressions as no future exertions can completely eradicate. Let us inquire coolly if the vices of the negroes may not have a similar origin.

In every part of Africa with which the nations of Europe have any commerce, slavery prevails of the worst kind. Three-fourths of the people are slaves to the rest, and the children are born to no other inheritance. "Most parts of the coast differ in their governments; some are absolute monarchies, while others draw near to an aristocracy. In both the authority of the chief or chiefs is unlimited, extending to life, and it is exercised as often as criminal cases require, unless death is commuted into slavery; in which case the offender is sold, and if the shipping will not buy the criminal, he is immediately put to death. Fathers of free condition have power to sell their children, but this power is very seldom enforced." In Congo, however, a father * will sell a son or daughter, or perhaps both, for a piece of cloth, a collar or girdle of coral or beads, and often for a bottle of wine or brandy. A husband may have as many wives as he pleases, and repudiate or even sell them, though with child, at his pleasure. The wives and concubines, though it be a capital crime for the former to break the conjugal faith, have a way to rid themselves of their husbands, if they have set their affections upon a new gallant, by accusing them of some crime for which the punishment is death. In a word, the bulk of the people in every state of Africa are born slaves to great men, reared as such, held as property, and as property sold (see SLAVERY). There are indeed many circumstances by which a free man may become a slave: such as being in debt, and not able to pay; and in some of such cases, if the debt be large, not only the debtor, but his family likewise, become the slaves of his creditor, and may be sold. Adultery is commonly punished in the same manner, both the offending parties being sold, and the purchase-money paid to the injured husband. *Obi*, or pretended witchcraft (in which all the negroes firmly believe, see WITCHCRAFT), is another, and a very common offence, for which slavery is adjudged the lawful punishment; and it extends to all the family of the offender. There are various other crimes which subject the offender and his children to be sold; and it is more than probable, that if there were no buyers, the poor wretches would be murdered without mercy.

Edwards's History of the West Indies, vol. ii.

* *Mod. Univ. History*, vol. xiii. p. 55.

Edwards's History of the West Indies.

In such a state of society, what dispositions can be looked for in the people, but cruelty, treachery, and revenge? Even in the civilized nations of Europe, blessed with the lights of law, science, and religion, some of the lower orders of the community consider it as a very trivial crime to defraud their superiors; whilst almost all look up to them with stupid malevolence or rancorous envy. That a depressed people, when they get power into their hands, are revengeful and cruel, the present age affords a dreadful proof in the conduct of the demagogues of a neighbouring nation; and is it wonderful that the negroes of Africa, unacquainted with moral principles, blinded by the cruellest and most absurd superstitions, and whose customs tend to eradicate from the mind all natural affection, should sometimes display to their lordly masters of European extraction the same spirit that has been so generally displayed by the lower orders of Frenchmen to their ecclesiastics, their nobles, and the family of their murdered sovereign! When we consider that the majority of the negroes groan under the cruellest slavery, both in their own country and in every other where they are to be found in considerable numbers, it can excite no surprise that they are in general treacherous, cruel, and vindictive. Such are the caprices of their tyrants at home, that they could not preserve their own lives or the lives of their families for any length of time, but by a perpetual vigilance, which must necessarily degenerate, first into cunning, and afterwards into treachery; and it is not conceivable that habits formed in Africa should be instantly thrown off in the West Indies, where they are the property of men whom some of them must consider as a different race of beings.

But

(A) 1. A white man with a negro woman, or a negro man with a white woman, produce a mulatto, half white and half black, or of a yellow-blackish colour, with black, short, frizzled hair. 2. A white man with a mulatto woman, or a negro with a mulatto woman, produce a *quadroon*, three fourths white and one fourth black, or three fourths black and one fourth white, or of a lighter yellow than the former. In America, they give the name of *cabres* to those who are descended from a black man and a mulatto woman, or a mulatto man and a black woman, who are three fourths black and one fourth white, and who are not so black as a negro, but blacker than a mulatto. 3. A white man with a quadroon woman, or a negro with a quadroon woman, produce a *mestizo*, seven eighths white and one eighth black, or seven eighths black and one eighth white. 4. A white man with a mestizo woman, or a negro with a mestizo woman, produce, the one almost a perfect white, the other almost a perfect black, called a *quinteroon*. This is the last gradation, there being no visible difference between the fair quinteroons and the whites; and the children of a white and quinteroon consider themselves as free from all taint of the negro race.

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But the truth is, that the ill qualities of the negroes have been greatly exaggerated. Mr Edwards, in his valuable Hiftory of the Weft Indies, affures us that the Mandingo negroes difplay fuch gentlenefs of difpofi- and demeanour, as would feem the refult of early education and difcipline, were it not that, generally fpeaking, they are more prone to theft than any of the African tribes. It has been fuppofed that this propenfity, among other vices, is natural to a ftate of flavery, which degrades and corrupts the human mind in a deplorable manner; but why the Mandingoes fhould have become more vicious in this refpect than the reft of the natives of Africa in the fame condition of life, is a queftion he cannot anfwer.

"The circumftances which (according to the fame author) diftinguifh the Koromantyn or Gold Coaft negroes from all others, are firmnefs both of body and mind; a ferocioufnefs of difpofition; but withal, activity, courage, and a ftubbornnefs, or what an ancient Roman would have deemed an elevation of foul, which prompts them to enterprifes of difficulty and danger, and enables them to meet death, in its moft horrible fhape, with fortitude or indifference. They fometimes take to labour with great promptitude and alacrity, and have conftitutions well adapted for it; for many of them have undoubtedly been flaves in Africa. But as the Gold Coaft is inhabited by various tribes, which are engaged in perpetual warfare and hoftility with each other, there cannot be a doubt that many of the captives taken in battle, and fold in the European fettlements, were of free condition in their native country, and perhaps the owners of flaves themfelves. It is not wonderful that fuch men fhould endeavour, even by means the moft defperate, to regain the freedom of which they have been deprived; nor do I conceive that any further circumftances are neceffary to prompt them to action, than that of being fold into captivity in a diftant country. One cannot furely but lament (fays our author), that a people thus naturally intrepid, fhould be funk into fo deplorable a ftate of barbarity and fuperftition; and that their fpirits fhould ever be broken down by the yoke of flavery! Whatever may be alleged concerning their ferocioufnefs and implacability in their prefent notions of right and wrong, I am perfuaded that they poffefs qualities which are capable of, and well deferve, cultivation and improvement.

"Very different from the Koromantyns are the negroes imported from the Bight of Benin, and known in the Weft Indies by the name of Eboes. So great is their conftitutional timidity and defpondency of mind as to occafion them very frequently to feek, in a voluntary death, a refuge from their own melancholy reflections. They require therefore the gentleft and mildeft treatment to reconcile them to their fituation; but if their confidence be once obtained, they manifeft as great fidelity, affection, and gratitude, as can reafonably be expected from men in a ftate of flavery. The females of this nation are better labourers than the men, probably from having been more hardly treated in Africa.

"The natives of Whidah, who, in the Weft Indies, are generally called *Papaws*, are unqueftionably the moft docile and beft-difpofed flaves that are imported from any part of Africa. Without the fierce and favage manners of the Koromantyn negroes, they are alfo happily exempt from the timid and defponding temper of the Eboes. The cheerful acquiefcence with which thefe people apply to the labours of the field, and their conftitutional aptitude for fuch employment, arife, without doubt, from the great attention paid to agriculture in their native country. Bofman fpeaks with rapture of the improved ftate of the foil, the number of villages, and the induftry, riches, and obliging manners of the natives. He obferves, however, that they are much greater thieves than thofe of the Gold Coaft, and very unlike them in another refpect, namely, in the dread of pain, and the apprehenfion of death. They are, fays he, fo very apprehenfive of death, that they are unwilling to hear it mentioned, for fear *that* alone fhould haften their end; and no man dares to fpeak of death in the prefence of the king, or any great man, under the penalty of fuffering it himfelf, as a punifhment for his prefumption. He relates further, that they are addicted to gaming beyond any people of Africa. All thefe propenfities are obfervable in the character of the Papaws in a ftate of flavery in the Weft Indies. That punifhment which excites the Koromantyn to rebel, and drives the Ebo negro to fuicide, is received by the Papaws as the chaftifement of legal authority, to which it is their duty to fubmit patiently. The cafe feems to be, that the generality of thefe people are in a ftate of abfolute flavery in Africa, and, having been habituated to a life of labour, they fubmit to a change of fituation with little reluctance."

Having recited fuch obfervations as occurred to him on contemplating the various tribes of negroes from each other, Mr Edwards thus eftimates their general character, influenced as they are by circumftances which foon efface the native and original impreffions which diftinguifh one nation from another when newly imported into the Weft Indies.

"Notwithftanding what has been related of the firmnefs and courage of the natives of the Gold Coaft, it is certain that the negroes in general in our iflands (fuch of them at leaft as have been any length of time in a ftate of fervitude) are of a diftruftful and cowardly difpofition. So degrading is the nature of flavery, that fortitude of mind is loft as free agency is reftrained. To the fame caufe probably muft be imputed their propenfity to conceal or violate the truth; which is fo general, that the vice of falfehood is one of the moft prominent features in their character. If a negro is afked even an indifferent queftion by his mafter, he feldom gives an immediate reply; but, affecting not to underftand what is faid, compels a repetition of the queftion, that he may have time to confider, not what is the true anfwer, but what is the moft politic one for him to give. The pronenefs obfervable in many of them to the vice of theft has already been noticed; and I am afraid (fays our author), that evil communication makes it almoft general. It is no eafy matter, I confefs, to difcriminate thofe circumftances which are the refult of proximate caufes, from thofe which are the effects of national cuftoms and early habits in favage life; but I am afraid that cowardice and diffimulation have been the properties of flavery in all ages, and will continue to be fo to the end of the world. It is a fituation that neceffarily fuppreffes many of the beft affections of the human heart.

heart.—If it calls forth any latent virtues, they are thoſe of ſympathy and compaſſion towards perſons in the ſame condition of life; and accordingly we find that the negroes in general are ſtrongly attached to their countrymen, but above all, to ſuch of their companions as came in the ſame ſhip with them from Africa. This is a ſtriking circumſtance: the term *ſhipmate* is underſtood among them as ſignifying a relationſhip of the moſt endearing nature; perhaps as recalling the time when the ſufferers were cut off together from their common country and kindred, and awakening reciprocal ſympathy from the remembrance of mutual affliction. But their benevolence, with a very few exceptions, extends no further. The ſofter virtues are ſeldom found in the boſom of the enſlaved African. Give him ſufficient authority and he becomes the moſt remorſeleſs of tyrants. Of all the degrees of wretchedneſs endured by the ſons of men, the greateſt, aſſuredly, is the miſery which is felt by thoſe who are unhappily doomed to be the ſlaves of ſlaves; a moſt unnatural relation, which ſometimes takes place in the ſugar plantations. The ſame obſervation may be made concerning their conduct towards the animal creation. Their treatment of cattle under their direction is brutal beyond belief. Even the uſeful and ſocial qualities of the dog ſecure to him no kind uſage from an African maſter. One of the moſt pleaſing traits in their character is the reſpect and attention which they pay to their aged countrymen. The whole body of negroes on a plantation muſt be reduced to a deplorable ſtate of wretchedneſs, if, at any time, they ſuffer their aged companions to want the common neceſſaries of life, or even many of its comforts, as far as they can procure them. They ſeem to be actuated on theſe occaſions by a kind of involuntary impulſe, operating as a primitive law of nature, which ſcorns to wait the cold dictates of reaſon: among them, it is the exerciſe of a common duty, which courts no obſervation, and looks for no applauſe."

As the colour, and features, and moral qualities of the negroes may be thus eaſily accounted for by the influence of climate and the modes of ſavage life, ſo there is good reaſon to believe that their intellectual endowments are equal to thoſe of the whites who have been found in the ſame circumſtances. Of thoſe imitative arts in which perfection can be attained only in an improved ſtate of ſociety, it is natural to ſuppoſe that they have but little knowledge; but the fabric and colours of the Guinea cloths are a proof of their native ingenuity. In the Weſt Indies many of them are expert carpenters, ſome watchmakers, and one or two have ſucceſsfully practiſed phyſic; whilſt others have figured both in Latin and in Engliſh poetry, ſo that we cannot doubt but that "God, who made the world, hath made of one blood all nations of men," and animated them with minds equally rational.

NEGROLAND, or Nigritia, a country of Africa, lying next to Guinea towards the north, and extending from 8° of weſt to 23° of eaſt longitude, and from 9° to 20° of north latitude. On the north it is bounded by Zara or the Deſert; on the eaſt, by countries unknown; on the ſouth, by Guinea; and on the weſt, by the Atlantic Ocean; and is watered by the great river Niger or Senegal, which runs through it from eaſt to weſt. The Europeans have ſettlements on the coaſts of this country, eſpecially near the mouths of the Niger and Gambia, which laſt is ſuppoſed to be a branch of the former. A great many nations inhabit the banks of the rivers; ſome Pagans, ſome Mohammedans, of different languages, and independent of one another. The country is fruitful, eſpecially along the rivers; abounding in rice, Guinea grain, and Indian corn, where it is cultivated; and with cocoa-nuts, plantains, pulſe, palm-trees, and tropical fruits; nor is it deſtitute of cattle, and a variety of other animals, particularly ſuch as abound in Guinea. See Guinea.

Negroland is fertilized by the overflowing of its rivers the Senegal and Gambia, as Egypt is by the Nile. It hath not yet been aſcertained whether the Gambia is a branch of the Senegal or not. As far as the Europeans have penetrated up the country, they appear to be diſtinct; and the Mundingo Negroes report that the Gambia has a different origin. The entrance into the Niger or Senegal river is narrow and ſomewhat difficult, by reaſon of its immoveable bar and ſandy ſhoals, as well as the ſeveral iſlands at the mouth of it, and the ſeveral canals and marſhes that clog it: but after ſailing up eight or ten leagues, it is found broad and deep, and fit to carry large veſſels; and, excepting about five or ſix leagues on each ſide above the mouth, which is ſandy and barren ground, the banks are covered with ſtately trees and villages, and the country in general is fertile and well watered; for, like the Nile, this river overflows its banks for many leagues, and enriches the land to a great degree, though, for want of ſkill, the inhabitants do not reap the advantages which they might obtain from its fertility. The people on both ſides of the river live as near to it as they can, and feed great herds of cattle, ſowing large and ſmall millet, the former of which is called by us *Turkey wheat*, in great quantities, and with great increaſe. If the river fails of overflowing at its uſual ſeaſon, a great ſcarcity enſues in the adjacent country; and, even when it overflows regularly, it breeds ſuch vaſt flights of graſshoppers and inſects, as quite darken the air, and frequently devour all the product of the earth: in which caſe the people kill thoſe inſects and eat them; which they do either by pounding in leathern bags, and then boiling them in milk, or, which is reckoned the more delicious method, by frying or broiling them over a light blaze in a frying-pan full of holes. Thus the legs and wings of the inſects are burnt off, and the reſt of the body is ſufficiently roaſted to be eaten as a dainty, which they look upon to be very wholeſome and nouriſhing.

To the eaſt, north-eaſt, and ſouth-eaſt of the iſland of Senegal, the country, as far as it is known, is over-run with woods and marſhes; the Senegal, Gambia, and Sherbro, which are looked upon by ſome as branches of one immenſe river, paſſing through it in their way to the Atlantic Ocean. During the rainy months, which begin in July, and continue to October, they lay the whole country under water; and indeed the ſudden riſe of theſe rivers is incredible to ſuch as are not acquainted with the violent rains that fall between the tropics. At Galam, 900 miles from the mouth of the Senegal, the waters riſe 150 feet perpendicular from the bed of the river. At the iſland of Senegal, the river riſes gradually, during the rainy

feafon, above 20 feet perpendicular over part of that flat coaft; which of itfelf fo frefhens the water, that fhips lying at anchor, at the diftance of three leagues from its mouth, generally make ufe of it, and fill their water there for their voyage home. When the rains are at an end, which foon happens in October, the intenfe heat of the fun ufually dries up thofe ftagnating waters which lie on the higher parts, and the remainder from lakes and marfhes, in which are found all forts of dead animals. At laft, thofe too are quite dried up; and then the effluvia that arife are almoft quite infupportable. At this feafon the winds blow fo hot from the land, that they may be compared to the heat proceeding from the mouth of an oven, and they bring with them an intolerable fmell. The wolves, tigers, lions, and other wild beafts, then refort to the river, fteeping their body under water, and only their fnout above it for the fake of breathing. The birds foar to an immenfe height in the air, and fly a vaft way over the fea, where they continue till the wind changes, and comes from the weft.

Negroes White. See HELIOPHOBI and ALBINO.

NEGROMANCY. See NECROMANCY.

NEGROPONT, anciently *Eubœa*, an ifland of the Archipelago, ftretching along the eaftern coaft of Achaia or Livadia, from which it is feparated by a narrow channel called the *Euripus*. This ftrait is fo narrow, that the ifland is joined to the continent by a bridge thrown over it; and here, it is thought, there was formerly an ifthmus. The irregularity of the tides in the Euripus hath from the remoteft antiquity been very remarkable, and this irregularity is found to be connected with the age of the moon. From the three laft days of the old moon to the eighth day of the new moon, and from the 14th to the 20th day inclufive, they are regular; but on the other days they are irregular, flowing 12, 13, or 14 times in the fpace of 24 hours, and ebbing as often. The ifland is 90 miles long and 25 broad in the wideft part; and produces corn, oil, fruit, and cattle, in great abundance. The only place in the ifland worth notice is the capital, which is alfo called *Negropont*; and which is walled, and contains about 15,000 inhabitants; but the Chriftians are faid to be much more numerous than the Turks. The captain bafhaw, or admiral of Turkey, who is alfo governor of the city, the ifland, and the adjacent continent of Greece, refides here; and the harbour, which is very fafe and fpacious, is feldom without a fleet of galleys, ready to be put to fea againft the pirates and the Maltefe. A part of the bridge between the city and the coaft of Greece, confifts of a drawbridge no longer than juft to let a galley pafs through.

END OF THE TWELFTH VOLUME.

DIRECTIONS FOR PLACING THE PLATES OF VOL. XII.